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TABLE OF CONTENTS.

ENGINEERING NEWS OF THE WEEK.....305, 319
Melan Concrete Arch of 100 ft. Span, Stockbridge, Mass. (Illustrated) 306
Beiver Valley Land & Irrigation Co.'s System in Southwestern Utah 307
Management of Steam-Heated Passenger Cars.... 307
Hydraulic Dredging Steamer "Gen. C. B. Comstock" (with inset, illustrated) 308
Proposed Flood Protection for Williamsport, Pa.. 309
Insulated Wires and Their Peculiarities..... 309
Growth of Population of Great Cities (illustrated). 310
Corn-Pith Cellulose for War Ships (illustrated).. 311
The Schuerman Computer..... 314
Tests of Long-Span Terra-Cotta Floor Arches (Illustrated) 314
Random Notes by Rail (Editorial Correspondence). 315
The Pasteur Institute and the Manufacture of Antitoxine 316
Improvement in the Construction of Interlocking Plants, Michigan Central R. R. (Illustrated)..... 317
Tests of the Electric Locomotive on the Baltimore & Ohio R. R..... 318
A Water System for Placer Mining and a New Method of Dam Building 318
The Marvin Electric Drill (illustrated)..... 319
EDITORIAL NOTES 312
Toronto's Revenue from Street Railway Franchises —Mr. Austin Corbin's Project for Shortening the Transatlantic Journey—Concrete Arches for Parks and Suburban Streets—The Prospects of Revenue from Sewage Farming—Credit for Work on the U. S. Lock at Sault Ste. Marie.
EDITORIAL:
Modern Transportation Facilities and the Growth of Cities 313
LETTERS TO THE EDITOR.....313
Gravity and Spring Nut-Locks—Notes and Queries.

The operation of a street railway cable by electric power has proved successful in Chicago, where about six miles of the State St. line of the Chicago City Ry. is operated by a 600-HP. Westinghouse multipolar motor. This plant has been in regular operation since Aug. 12, and mechanically has worked very satisfactorily, but not enough experience has yet been had under varying conditions to know whether it will be an economical success or not. The motor receives its current from the company's electric power house only a short distance away, so that very little power is lost in transmission, making the conditions exceptionally favorable. Generally from 400 to 600 amperes are used; but at morning and evening this amount is generally increased to about 1,000 amperes, or about the rated capacity of the motor, 600 HP. The main starting rheostat often has to stand 1,500 amperes when starting the motor with a load. Thus far the motor has worked on an average about 22 hours per day, and has given no trouble. From the motor shaft the power is transferred to a main shaft by belt, and the main shaft gears through spurs with the cable drum shaft. The crucial point in the success of this plant will be its economy as compared with the direct use of steam power, and it is interesting to note that careful records are being kept relative to this feature. In a future issue we hope to give some exact figures showing the results of the experiment. Mr. Robert J. Hill is Chief Engineer of the Chicago City Ry. Co.

Electric traction is proposed by the Bennington & Rutland R. R. for the passenger service on its branch from Bennington to North Bennington, a distance of five miles. The freight traffic will continue to be handled by steam engines.

A cable-slot plow has been devised for removing accumulated debris from cable conduits. This plow has a wrought iron blade, is shaped to fit the conduit, and the iron handle which passes through the slot is forked, or V-shaped. To one fork the horse which pulls the plow is hitched, and two men bear down upon the other handle, to keep the blade in contact with the bottom of the conduit. The material is thus scraped to the manholes, where it can be removed.

Combination mail and passenger cars, 25 ft. long, with 13-ft. mail compartments, have recently been put in service on the Manayunk electric line of the Philadelphia Traction Co. They are motor cars, and run independently of the passenger cars.

A counterbalance system is to be adopted for the Fourth St. and Selby Ave. street railway in St. Paul, Minn., on which line cable traction is to be superseded by electric traction. The line has a very steep grade, and a counterbalance car running in a conduit between the tracks and attached to the electric car by a cable will enable the cars to be run with safety.

An electric motor suit, covering the patents on the mounting of electric motors on car axles in such a way as to enable the gearing to drive the axle without transmitting shocks to the motor, has been brought by the Adams Electric Ry. Co. against the Lindell Ry. Co., of St. Louis. Mr. Wellington Adams, one of the promoters of the defunct Chicago & St. Louis Electric Ry. scheme, claims that his patents cover this method of mounting car motors, which is used by many companies.

A new cable incline at Chattanooga, Tenn., is nearly completed, and is said to have a rise of 1,450 ft. in a distance of nearly a mile. The engineer is Mr. Linn White, of Chattanooga.

The report of the Nicaragua Canal Commission was handed to the President through Secretary of State Olney on Nov. 1, as required by the Act of Congress. But the text of the report will not be made public, it is said, until the meeting of Congress on Dec. 1. It is reported, however, that the Commission finds the canal entirely feasible and worthy of execution; but some changes in route are probably suggested, along with a somewhat greater estimate of cost of execution.

A number of steam hopper barges for the North Sea Ship Canal have been built by Mr. Smulders, of Rotterdam, Holland, and are of the following dimensions: Length, 118 ft.; beam, 23 ft.; depth of hull, 9.2 ft.; width of hopper, 17 ft. at top and 8.66 ft. at bottom; length of hopper, 52.5 ft. The engines are of the marine type, and are of two sizes. The larger engines have cylinders 15.35 × 17.71 ins. and 28 × 71 ins., and develop 225 I. HP. at 440 revolutions per minute. The smaller ones have cylinders 9.84 × 17.71 ins. and 27.75 × 71 ins., and develop 175 I. HP. at 440 revolutions. Steam is supplied by a marine boiler 9.84 ft. long and 8.86 ft. wide, carrying 100 lbs. steam pressure and having a single corrugated furnace. The barges can carry 300 tons of material at a speed of seven knots.

Small dredges for irrigation canals and shallow water have recently been built by Hunter & English, of London, England. One bucket dredge, with a draft of 35 ins., could excavate from 8 ft. below to 2 ft. above the water line, delivering into scows or into a shore conveyor 120 ft. long. They have also built a dredge of 3 ft. draft, for work on Lake Titicaca, Peru, 12,000 ft. above sea level. This machine delivers 60 to 70 cu. yds. per hour at a distance of 100 ft., and at a cost of about 3½ cts. per cu. yd. for 100,000 cu. yds. delivered, although coal costs $21 to $23 per ton alongside the dredge. Another machine, with a draft of 2 ft., and cutting 8 ft. up from the bottom, has been designed for the Leeds & Liverpool Canal. As it has to pass under several low bridges, the framework carrying the top tumbler is supported by shear legs, the legs and frame being lowered by the vessel's engines, so that a headway of only 10 ft. is required. The material is delivered by a conveyor into scows moored astern, so as to avoid blocking the waterway. This dredge is chiefly used for trimming the slopes of the canal banks.

The Dismal Swamp Canal is to be reconstructed, and contracts are already awarded. This canal, built under a charter of 1787, extends from Norfolk, Va., to Elizabeth City, N. C., a distance of 48½ miles. The present width of 32 ft. is to be increased to 60 ft., and the depth is to be 10 ft. throughout. The five locks will be reduced to three, and the summit level will be cut down 7 ft. The Deep Creek and South Mills locks will be 250 × 40 ft., with 12 ft. lift.

The development of the North Sea and Baltic Ship Canal is said to be checked by the heavy dues imposed. The Stettin Chamber of Commerce reports that in August 718 vessels, with an aggregate tonnage of 115,668 tons, passed through the canal, as compared with 500 vessels of 74,000 tons, in the aggregate, using the canal in July. But of the 718 vessels, only 295 exceeded 100 tons measurement, though the canal was available for ships of 21 ft. draft. Nearly 50% of the whole August traffic was bound to or from Hamburg. The cause of the scanty traffic is said to be the high tolls and the stoppage at night due to defective lighting. The Stettin merchants say that under present tolls the evidence proves that the passage of the canal only pays for vessels under 500 tons burden.

The most serious railway accident of the week was a head collision on the Missouri Pacific Ry., near St. Louis, Mo., Oct. 30. Three persons were killed, and about 12 injured, some very seriously.——A broken car wheel caused the derailment of four cars of an express train on the Baltimore & Ohio R. R., near Wheeling, W. Va., on Nov. 3. Two persons were killed.

The tail shaft of the Netherlands line steamer "Obdam" broke on her last voyage from Rotterdam to New York, and she was towed into Halifax by the "Pennland" of the American Line.

An audible block signal, in which a bell on the engine is rung by an electric circuit from the rails, has been tried recently on the Chicago & Eastern Illinois R. R. The contact is made by a suspended brush on the engine and a fixed contact plate between the rails at the end of each block. An open switch, or broken rail, or the presence of a car or train upon the block, will cause the bell to ring. The signal is the invention of Mr. S. B. Cornell.

Railway trains approaching grade crossings of street car lines at Washington, D. C., are required to come to a stop before reaching the crossing, according to a regulation recently adopted by the District Commissioners.

The American Line steamship "St. Louis" broke her rudder frame about 800 miles west of Southampton on Oct. 22. A heavy sea striking the frame caused the accident, but she was steered into port by her twin screws, at a 15-knot rate of speed. This is the second time the "St. Louis" has had trouble with her rudder, as she came into New York from her first trip with a broken rudder. The frame of the rudder is made of forged wrought iron, with a curved bottom, and five arms riveted to the sheet of steel forming the blade. The rudder just broken was one built for the "St. Paul," and substituted for the one broken last June.

The harbor-defense ram "Katahdin" had an official trial on Long Island Sound on Oct. 31. The contract speed is 17 knots, but this speed was not quite touched, in spite of the allowances made for wind and tide. The first total run of 17 nautical miles was made in 1 h. 5 min. 32 sec., and the return trip consumed 1 h. 0 min. 44 sec., or 2 h. 6 min. 16 sec. for the run of 34 miles. The average steam pressure was 168 lbs.; condenser vacuum, 25½ ins.; average air-pressure a little less than 2 ins. of water, with fires under forced draft. There was very little vibration in the vessel. She turned very quickly, and was generally satisfactory in behavior. The "Katahdin" is of steel, and was built by the Bath Iron Works, of Bath, Me. The keel was laid in 1891, and the contract price was $930,000. The length on load water line is 250 ft. 9 ins.; beam, 43 ft. 5 ins.; mean draft, 15 ft.; displacement, 2,183 tons; maximum I. HP. 4,800. The sides are plated with 6-in. armor, and the vessel is armed with four 6-pdr. rapid-fire guns. The "Katahdin" was launched and given preliminary tests some time ago, but since then alterations have been made in her screws to increase the speed. Under the contract calling for 17 knots as a minimum, the ram is rejected. The Secretary of the Navy says he is powerless to act otherwise under the specifications of the contract, and unless the coming Congress makes some special provision for the ram, the Bath Iron Works must rely upon a sale to a foreign government for a return upon its expenditure. But as the U. S. Government is said to have some hundreds of thousands invested in armor on this vessel useless for other purposes, some arrangement is likely to be made. Meanwhile the government has consented to care for the "Kathadin" at the Brooklyn Navy Yard pending further action in the case.

Attempts to dispose, at a profit, of the sewage from the new gravity outfall sewer at Salt Lake City, described in our issue of Jan. 4, 1894, have thus far met with failure. After two or three postponements of the date for opening bids, it was found that only one proposal had been received, and that was on a basis of a yearly payment by the city for disposal, the rate to be $10,000 a year for a five-years' contract, $12,000 for a 10, and $15,000 for a 20-years' contract. The city offered the use of 75 acres of land, as well as its sewage. A recent attempt to secure bids for a part of the sewage of Denver also failed to bring the desired offers.

Specifications for trial garbage crematories have been adopted by a committee of the Chicago Councils. They provide that the city will furnish, free of cost, sites upon which any parties desiring to submit a garbage crematory for test may do so. Such furnaces must be constructed without expense to the city, in case it is rejected after test, and not over $10,000 will be paid for any furnace with a capacity of 50 tons in 10 hours. No furnace will be accepted which is not shown by test to be capable of consuming garbage in a perfectly sanitary manner at a cost of not over 30 cts. a ton, "including every expense of operation." The city will deliver garbage and the owners of the various furnaces must operate them for 90 days, the city paying 65 cts. a ton for all garbage actually consumed.

A smoke-consuming furnace, built by the Manhattan Furnace Co., of Chicago, is about to be tried at the Hunt St. pumping station of the Cincinnati waterworks, under a guarantee to consume 95% of the smoke and save 10% of the fuel. The company agrees to equip the battery of two boilers, supply all material and labor, and keep the furnaces in repair for one year, at a cost not to exceed $250 per boiler. A proposition from the Hawley Down-Draft Furnace Co. to equip an additional battery of two boilers in the Hunt St. pumping station with their furnace was also accepted by the city. The price to be paid is $497.50 per boiler. The Hawley Co. also guarantees to prevent 95% of smoke and to save 10% of the fuel.

MELAN CONCRETE ARCH OF 100-FT. SPAN, STOCKBRIDGE, MASS.

By Fr. Von Emperger, C. E.

The Housatonic River seems to be one of the most frequently bridged little rivers in New England, and it certainly affords to the traveler on the railway running along its shores as much information in this line as a history of bridge building.

There is, of course, a lack of massive stone arch bridges, but samples of the old wooden bridge, with its quaint roof, can still be seen, while the remainder are iron bridges in a variety of forms. It is not long since these latter made their appearance, and they were at first looked upon with great suspicion, partly on account of their great cost and partly through doubts as to their durability.

Somewhat similar objections have been met with by a new contestant in the field, a bridge system which the continuous progress of engineering science has brought forward, and which is shown in

CONCRETE ARCH OF 100 FT. SPAN, IN ICE GLEN, STOCKBRIDGE, MASS.

the adjoining cut—viz., a concrete-iron arch on the Melan system, which has been recently completed by the writer at Stockbridge, Mass.

In regard to span, this is the longest concrete arch in this country, although the work itself is comparatively small, being merely a footbridge intended to accommodate the tourists and sightseers, and give them easy access from Laurel Hill to the interesting and picturesque Ice Glen, one of the chief attractions of the renowned Berkshire Hills.

The bridge itself was built as a segmental arch of 100-ft. span and 1-10 rise. The banks of the river on each side were of unequal height, and consequently the face walls had to be made on a different grade, which necessarily gives the arch an unsymmetrical appearance.

The iron in the arch consisted of bent ribs of 7-in. 15-lb. I-beams, spaced 28 ins. apart and raised about 1½ to 2 ins. from the soffit. The concrete in the abutments (1 cement, 3 sand and 6 stone) was put in first, and these and the adjoining wing walls were put up to such a height as to enclose the ends of the iron ribs, which abutted against an iron cross-angle previously bolted to them. The iron ribs are kept in place by wooden braces between them and by supports from below until the concrete reached their ends when these supports were removed.

The concrete in the arch is 9 ins. thick at the crown and 30 ins. at the haunches. The concreting of the arch was done in one day. About 22 cu. yds. of concrete was used, which was laid by a force of 24 workmen. Then the concrete filling, the face and wing walls, and finally the coping, were built. The concrete for the arch was made of 1 cement, 2 sand and 4 stone, which was enriched to 1 cement to 4½ aggregate near the center. Aalborg cement was used for the whole structure, and the sand and gravel used were dug out of the river. The gravel was mixed in the proportion of 4 : 1 with broken stone.

The bridge is a concrete monolith, the coping forming one piece with the arch. The iron railing is embedded in the concrete. The falsework was struck after six weeks; the parts near the shores were removed two weeks earlier to allow the arch to take part in the settlement of the abutments.

By the use of planed boards it is comparatively easy to get flush face walls, because they can be removed quickly (in one or two days) and finished over, but it is somewhat difficult to accomplish this on the soffit, especially as it was advisable for the purpose of economy to use cheap, rough boards which were unequal in thickness and did not fit close together, all of which will show clearly in the concrete when the falsework is removed after the work is fully set. It is a further difficulty that the falsework is wet during the concreting, and later, if dried out, shrinks, and so it may happen that the weight of the bridge will be taken off the centers in a couple of days after the completion of the concreting.

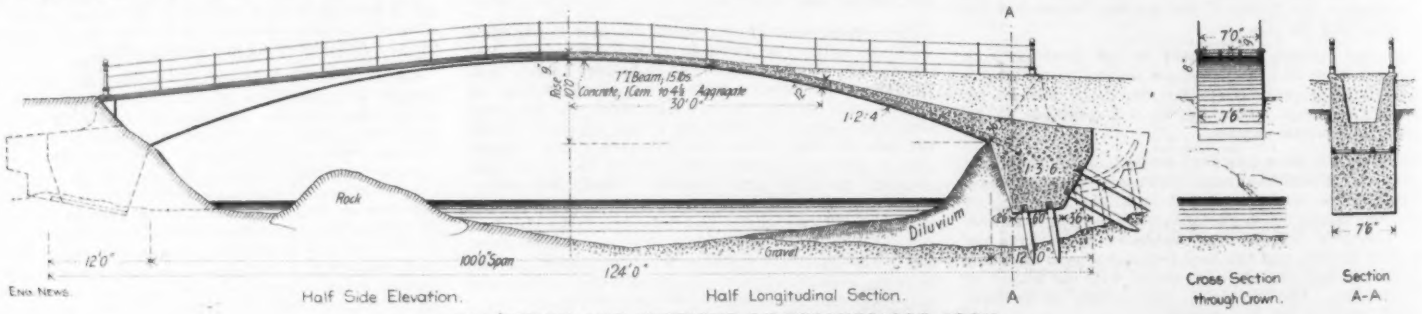
The following method was adopted in Stockbridge to avoid both these difficulties: The lagging was very rough, and was covered first with a thick layer of puddled clay, which was covered with thick paper at an equal distance below the previously-laid arch beams. In this way a smooth surface was secured, and at the same time the lagging was kept wet all the time. After striking the centers the arch settled about ½ in. at the abutments and ¾ in. at the center.

The bridge was built for the Laurel Hill Association for $1,475, a sum bequeathed to it for this purpose by the late Mrs. J. K. Goodrich. This figure, based on an estimate for a light iron bridge, would have covered the entire cost of this plain concrete arch if the foundation had proved to be rock, as was claimed, which could not be investigated at the time of the letting, as it was in the middle of winter. For this reason the contract was limited to work above water level, and it was not until considerable work had been done that the foundation showed up its worst side. Then, as no other funds were available, the writer decided to do the work at his own expense. The supposed rock foundation proved to be even worse than quicksand, being stone boulders imbedded in alluvial mud, a combination which never allows of a judgment as to whether the soil will give a good bearing or not. It was, for instance, supposed that a rock bottom extended under the excavation for a whole abutment, but this again proved to be a simple deception, as it was only a very big but thin stone a couple of inches thick, under which, as was discovered afterwards, was a layer of mud. This necessitated the removal of the concrete already laid and excavating to the level of what appeared to be gravel, so that now this foundation is partly on such a stone boulder and partly on a grillage made on this gravel. On the other side the gravel bed could not be reached, and a pile foundation combined with wing walls was resorted to.

The wing walls were reinforced longitudinally by embedding in each of them a steel beam, as shown in the sectional view. It would be a correct criticism to say that these foundations are lacking in uniformity; but the writer did not consider himself bound to go to so great an expense as would surely have been involved had the work of making them uniform been undertaken.

One week after lowering the falsework a loading test of the arch was made under the supervision of my assistant, Mr. Wm. Mueser. The falsework was left standing with its top 4 to 6 ins. below the soffit to afford an opportunity for the measurement of the deflection. For the purpose of loading, empty cement barrels were used, filled with earth near the abutments, while those near the center were filled partly with earth and partly with water pumped from the river. The test was started early in the morning, and the bridge was kept loaded during the whole day. The specified load is 75 lbs. per sq. ft. over an area of 7 × 100 ft., or 52,500 lbs. This load was represented by 143 barrels in two rows, which would correspond to 367 lbs. for each of them, as an average, and the test load was doubtless considerably surpassed without counting the waste water from leaking barrels. At 5 p. m. a one-sided load test was made by removing half the load from the Laurel Hill side.

Neither of these loads was followed by a measurable deflection, which, compared with iron bridges, is rather surprising, if we do not consider the different proportions between dead load and live load, which in our case was more than three to one, while in a plank floor bridge of such a span almost the opposite is the case. After this the falsework was entirely removed and the bridge was again opened for travel.



ELEVATION AND SECTIONS OF STOCKBRIDGE ARCH.

For the sake of comparison, it may be well to add that a Monier arch of 127 ft. span and 1-10 rise was built for a highway bridge in Wildegg (Switzerland), which was 6.7 ins. thick at the center and 9.8 ins. at the haunches, and this bridge was tested by the Swiss Society of Engineers and Architects, by loading it with wagons, to their full satisfaction.

This is simply to show that the above designed footbridge is far from being "skinned," as might appear to any one not accustomed to this kind of construction.

BEAVER VALLEY LAND & IRRIGATION CO.'S SYSTEM IN SOUTHWESTERN UTAH.

By W. P. Hardesty, C. E.

The Beaver Valley is in southwestern Utah, in the counties of Beaver and Millard, and is traversed by the river of the same name. The portion to be described extends in a north and south direction for about 20 miles, with a maximum width of five miles. The average elevation of the valley is about 4,900 ft. above sea level. The annual rainfall is about 15 ins.—not enough to allow of general agriculture without the aid of irrigation. The valley is surrounded by mountains, except on the south side, and the snowfall on these is the main supply of the Beaver River. The river has a total drainage area of 1,500 sq. miles, a length of about 150 miles, and discharges into Sevier River. The Pioche and California extension of the Union Pacific Railway traverses the valley, thus affording direct connection with Salt Lake City and Ogden. Near the southern end of the valley is a natural reservoir site, which appears to have been the bed of a small lake.

The Beaver River Irrigation Co. was organized in May, 1892, to convert this lake bed into a reservoir, with the idea of storing the surplus water of the river for irrigation. Mr. J. W. Reagan was selected as Chief Engineer, and has designed all their works. A site for a dam was selected about one mile below the outlet or north end of the lake basin. Here the low bluffs hem in the river, and a small oblong butte stretches crossways of the outlet, very materially reducing the work of damming it.

The reservoir site covers an area of 2,477 acres, having a length of 5¼ miles, an average width of ¾ miles, with a perimeter of 13¾ miles. On the west side, and adjoining the site near the south end, is the town of Milford, 221 miles from Salt Lake City.

The maximum depth of the reservoir when full will be 18 ft., the mean depth 8.88 ft., and the capacity 659,000,000 cu. ft. The owners estimate that an allowance of 1 ft. depth will cover the loss by seepage and evaporation during the irrigation season, leaving 626,000,000 cu. ft. as effective capacity, and, accepting 9 ins. as the total depth of flooding per season, as given by a U. S. Government report, they deem this amount sufficient for 19,000 acres of land. The low-water flow of the Beaver River during the irrigation season is already appropriated, so the reservoir depends for its supply on the discharge for the remainder of the year. The high-water flow occurs during May and June.

In 1892 a series of gagings was taken and recorded, from April 25 to July 4. The velocity was not directly measured, as is done by the U. S. Geological Survey, but the fall of the stream, averaging here 2½ ft. per mile, was carefully ascertained for a distance of about ¼ mile. A series of nine cross-sections at intervals of 150 ft. were taken, from which an average one was plotted, and a daily record was kept of the elevation of the water. From the given slope and cross-section thus found, the velocity was daily computed by Kutter's formula.

It was found that 70% of the total discharge of the stream during this period was sufficient to fill the reservoir. It is intended in use to fill the reservoir by the flow during the non-irrigating season, and thus start in on the season with reservoir full, and to replenish during May and June, thereby adding 50% to 100% to the reservoir's duty for the season's work, and enabling it to serve for 32,000 acres.

The total length of the dam is 1,800 ft. Of this 250 ft. is above, and rests against the butte mentioned above, and averages 25 ft. in height. Of the balance, 1,000 ft. on the west side has a maximum height of 8 ft., and 550 ft. on the east side a maximum height of 14 ft. The foundations rest on a compact blue clay, 7½ ft. below the surface. Beneath the middle of the main portion of the dam a trench, 4 ft. wide and 9 ft. deep, was dug and filled with selected material. A similar but much smaller trench was put in near the inner toe. The dam proper is of puddled earth, with its inner slope paved from top to bottom with flat stone on edge 1 ft. deep. The wet slope was changed from 2 to 1, after partial completion, to 3 to 1, to give a better resistance to wave action. The lower slope is 1½ to 1. When completed the top of the dam will be 10 ft. wide and 5 ft. above water-level.

In construction, nearly pure clay was used from pits near by; this was spread in layers 6 ins. deep, sprinkled and then rolled with a corrugated roller weighing 4,500 lbs. The body of this roller was 6 ft. long and 4 ft. in diameter, made of wooden staves, the inside being filled with smelter slag. On the outside, and spaced about 8 ins. in the clear, were huge wooden hoops, 2 ins. wide by 8 ins. deep. The roller was passed over each layer six to eight times, cutting up and then packing the earth very thoroughly. The last rolling but one needed to flatten and level it out completely was given, when it would be left for the next layer, so as to give a better bond. Mr. Reagan states that repeated measures of the material in the pits and then in the dam showed that 1.9 cu. yds. was thus compressed into 1 cu. yd.

The outlet to the reservoir is through an arched masonry culvert. 3½ ft. wide, 5½ ft. high and 43½ ft. long. The inlet tower, or penstock, as it is locally called, is 8 ft. square and 17 ft. high. It is of 8 × 8-in. timbers, and is surmounted by a small house. The front or inlet side of the tower is divided into three sections, provided with flash-boards, each about 1 ft. wide by 2½ ft. long. The water falls over the flash-boards onto a 3-ft. cushion of water at the bottom of the tower. Over the mouth of the culvert is placed a single gate, which is operated by a chain and windlass from the tower house.

The spillway is 400 ft. west of the tunnel, with the 10-ft. bottom at flood level of the reservoir. It is cut through the hard material for a distance of about 900 ft., with depth of 5 to 9 ft. A three-section gate 5 ft. high and of the same kind as used at the tower is placed at the head of this spillway, so that the water level can be raised to encroach on the 5-ft. clearance at dam as much as desired.

About 50 sq. miles, or 32,000 acres of land, are to be reclaimed under the reservoir. This lies to the north of the reservoir, and at an average elevation of 80 ft. below it. About 17,000 acres of this area is bottom land, and the balance bench land. This bottom land is an exceedingly deep, black, rich alluvial soil, well adapted to the growing of crops of all kinds. The bench land lies back from the bottom land, with an average elevation of 10 to 20 ft. above it. The soil is a sandy loam, well adapted to the growth of fruits, as well as grain and vegetables.

At a distance of five miles from the dam the canal divides into two branches. The main branch falls 48.4 ft. in the first 4¾ miles, of which 10.4 ft. was used in grade, and the balance of 38 ft. was overcome by 12 drops. These drops are constructed of 2-in. Oregon fir, with cedar piling, and are provided with water cushions. This branch will be carried north along the railroad about eight miles further.

The two main branches are each constructed with 10-ft. bottoms, side slopes of 1 to 1 and 1½ to 1, and carry 5 ft. depth of water. These dimensions give a narrow and deep cross-section for a channel, materially reducing loss by evaporation.

The line for the main canal was surveyed for a total length of 21 miles. Both it and the main laterals have a regular alinement of curves and tangents. The two main branches of the canal each run about 10,000 cu. yds. per mile in excavation.

Four large laterals have been located to cover about 7,000 acres, the present capacity of the reservoir. They will probably average about 4,000 cu. yds. in excavation per mile. Earth is moved here for small ditches at about 7 cts. per cu. yd., while it costs about 10 cts. for heavy work, where the haul is considerable. About 1⅛ miles of the railway will have to be raised 10 ft. before the reservoir is filled to its ultimate capacity.

The Beaver Land & Irrigation Co. was organized in 1894 and bought out the old company. The estimated cost of bringing water onto the 32,000 acres of land it is proposed to reclaim is about $90,000.

The company sells water rights at $10 per acre, with an annual fee of 50 cts. per acre for maintenance. If properly managed, this enterprise should prove to be a lucrative investment, with good returns to the owners. The company's headquarters are at Salt Lake City. Mr. Jas. D. Pardee is President, and Mr. F. H. Holloway, General Manager, while Mr. J. W. Reagan has been Chief Engineer for the work so far done.

MANAGEMENT OF STEAM-HEATED PASSENGER CARS.*

Our cars are all furnished with a train-pipe for the conveyance of the main supply of steam, and these train-pipes coupled one to another form a continuous line throughout the train. The boiler of the engine is connected with the train-pipe, and when steam is admitted to the train-pipe we are enabled to take a supply from the pipe into each car. When admitted into the car through the supply valve or controlling valve, the steam goes directly into the radiating pipes in some cars, and the air is heated by coming in contact with these steam-heated pipes. In other cars the steam does not radiate its heat directly into the car, but is used to heat the water in what is commonly known as the Baker heater systems. In some cases it is injected into the water, and in others heats the water by coming in contact with pipes or surfaces through or under which the water circulates. In each case the result of the radiation of the heat from the steam results in the formation of water by condensation. This water continually forming must be disposed of. In some cars it is drained to a low point, where is located a valve or cock, which must be opened sufficiently to let it escape. In other cars the condensation is drained to automatic steam-traps, which are designed to automatically discharge the water and retain the steam. Condensation is also continually taking place in the train-pipe—this must also be discharged periodically.

The principal factor in the successful handling of steam heat is the proper disposal of the condensation. Employees in charge of steam-heat equipment should bear in mind that the steam used for heating is continually forming water by condensation, and that if allowed to accumulate and get cold, this water will freeze. They should familiarize themselves with the apparatus in their charge, so as to know where condensation accumulates under various conditions, and know when and how to discharge it. Printed instructions should be issued to employees for their instruction and guidance, and a brief and lucid description should be given of the apparatus in use on the home cars, and also of all other systems used in cars operating over your lines. Instructions to enginemen should then be issued, fixing the pressure of steam to be carried in train-pipes under various circumstances, when to shut off steam, etc.

Directions should then be given for inspectors and trainmen to govern themselves by in making up trains; caring for them while running; changing engines at division points; cutting cars in and out, and when approaching terminals; also showing condition apparatus must be placed in when cars are left in yard, or when steam is cut out for any reason. General instructions should then follow, to bring about a watchful control of the temperature in the cars to secure the greatest degree of comfort to passengers. Ventilation should also be urged, and proper instructions given. The handling of disconnected cars, and cars, such as express and baggage cars, not heated inside, should also be covered.

In reply to the letters of inquiry as to whether the use of a trap is necessary or advisable, we have received replies representing eight roads. Four of these roads are using steam traps, and report them satisfactory. Four of them have discarded traps and have substituted drip-valves, the use of which is reported as satisfactory. The reasons urged for using traps are that "they are more reliable than depending upon trainmen, and that they take care of the varying condensation automatically."

The reasons given for discarding traps are: "On ac-

* Abstract of the report of a committee presented at the September meeting of the Central Railway Club, Buffalo, N. Y., on Sept. 13.

count of their being entirely unreliable. When adjusted at one point at a certain temperature, they would be found, at a point 100 miles or more distant, where there was quite a different temperature, giving unsatisfactory work, either by the discharging of too much steam with the water, or else by not allowing the water of condensation to discharge sufficiently rapidly to prevent freezing." "We had many cars freeze up, and many traps frozen. They also clog up with scale or dirt." "Have not found a trap that will do the work satisfactorily, on account of freezing up." It will be apparent that what little information we have received from members appears to be pretty evenly divided for and against steam traps.

The replies to our circular letter show that the maximum pressure allowed in blowing out train pipes varies with different lines from 20 to 100 lbs.; and that the maximum pressure permitted to be carried in the train pipe while trains are running is the same. Nearly all the companies replying carry their sleepers at the rear of train, but nearly all believe that where such sleepers are equipped with indirect systems of steam heating, they should be carried at the head end. Some of them divide the responsibility for heating apparatus in their trains between the train crew and the porters, and others hold the train crews responsible for all heating apparatus.

HYDRAULIC DREDGING STEAMER "GEN. C. B. COMSTOCK."

(With Inset.)

In the accompanying cuts and on our inset sheet this week we illustrate in considerable detail the construction of the large ocean-going hydraulic suction dredge built for the United States Government by the Bucyrus Steam Shovel & Dredge Co., of South Milwaukee, Wis., and designed to be used in the deepening of Galveston Harbor, Texas. As is quite well known, the works now being carried out there under the supervision of Maj. A. M. Miller, U. S. Engineer Corps, have for their object the creation of a deep-water port, and one of the first and principal necessities was the deepening of the bar, which obstructs the entrance to the bay on which the city of Galveston is situated. For a long time this bar has restricted the draft of water of vessels entering the harbor to 10 or 12 ft. A considerable improvement in depth has been effected in recent years by the construction of jetties, so that the ebb and flow of the tide between them helps to create and maintain a deep channel, but the action of the tides was insufficient to accomplish the result, and it became necessary to dredge the bar, which is a very fine, hard, white sand.

After careful consideration, the Government engineers decided that the type of dredge best adapted for the work was a suction dredge, with hoppers for receiving the material, and so constructed that it could convey the material out to sea in any ordinary stormy weather. The reasons for this concluclusion are plain, when the character of the material to be excavated and the conditions of dredging at sea are remembered. The dredging of ocean bars presents a set of conditions entirely different from those met with in ordinary dredging. Owing to the exposed situation, and the consequent necessity of working in considerable sea-way, it is impracticable to use anchorages of any kind, or to load the material into scows alongside. The type of dredge required, therefore, is a self-propelling hopper steamer, equipped with centrifugal dredging pumps, which pump up the sand from the bar while the vessel is being slowly steamed over it, the sand being received into the hoppers in the hold of the vessel, and discharged at sea through valves in the bottom.

The steamer "Gen. C. B. Comstock" is perhaps, the latest and most complete example of a vessel of this type, and her trial performance shows that she is capable of very excellent work. The hull is of wood, 177 ft. long over all, 35 ft. 6 ins. beam, 16 ft. depth of hold, and the two hoppers have a collective capacity of 500 cu. yds. when filled to the level of the main deck. They can, however, be filled considerably higher than this, as they are surrounded by a coaming 33 ins. high. The choice of wood, instead of steel, for the hull, was made on account of the greater freedom from fouling of a copper bottom as compared with a steel bottom. This trouble is a serious one in the semi-tropical waters of the Gulf of Mexico, where fouling takes place rapidly, and dry-dock facilities are difficult to obtain. The general apperance of the dredge is shown by Fig. 1, and it will be noticed that she is an ocean steamer of very respectable size. She is propelled by a fore and aft compound surface-condensing engine, having a high-pressure cylinder 26 ins. in diameter, and low-pressure cylinder 36 ins. in diameter, and 26 ins. stroke. This can drive the vessel at a speed of 10 miles per hour when light, and 8 miles per hour when loaded. Steam is furnished by two marine boilers 10 ft. in diameter by 11 ft. 6 ins. long, each boiler having two Fox corrugated furnaces. Immediately forward of the boilers is the pump room. Here are located two indepeadent centrifugal dredging pumps, each driven by compound direct-connected engines of 125 HP. These engines, with the pump, are illustrated in Fig. 2. The engines are good examples of marine compound high-speed engines, and all the parts are proportioned with unusual liberality, the object being to construct the very best engine that could be built for the purpose. The cross-heads are of cast steel, and the crank shaft and connecting rods are of solid forged steel. The pump has 15-in. suction and discharge pipes, and is specially designed to withstand the abrasion and wear of the sand, and to give freedom of flow through the passages. The blades

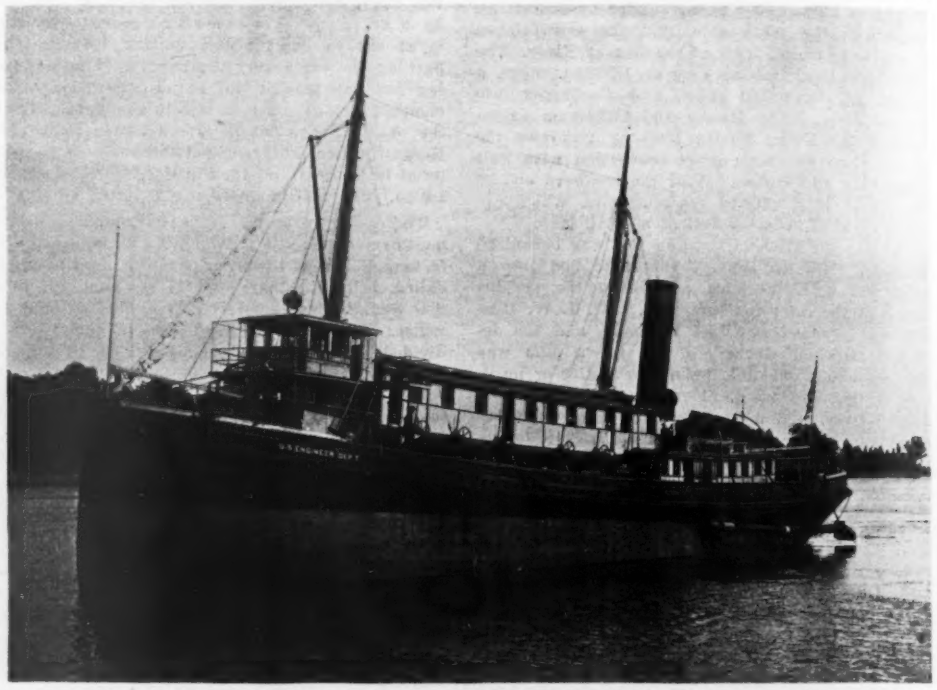


FIG. 1. OCEAN GOING HYDRAULIC-SUCTION HOPPER DREDGE "GEN. C. B. COMSTOCK."

of the runner are of steel, and are removable through a man-hole in the casing. There is a thrust bearing on the shaft of the pump of the multiple collar type, and an intercepting pressure chamber provides for the exclusion of the sand from the pump shaft bearing. The cranks are balanced, and the engine runs smoothly and steadily at 200 revolutions, but in ordinary work the speed is about 185 revolutions.

The suction pipes enter through the side of the boat, just above the load water line. There is a heavy flanged socket casting fitted into the side of the vessel, which receives the swivel elbow of the suction pipe. The elbow is a steel casting, and has sufficient length of bearing in the socket to hold it in place, and take the entire strain of the suction pipe, without any additional support. The stuffing box for the elbow is inside the boat, and easy of access from the pump room. The general arrangement of the pumps and suction elbow is shown in the cross-section of the hull, on the inset sheet. The suction pipe is 50 ft. long, in two sections, and made of wrought iron welded tubing. There are two flexible connections in the pipe, to permit freedom of movement in a sea-way under all conditions. The flexible connections are short, and formed by a rubber sleeve, and the strain is taken up by a heavy steel hinge joint, outside the sleeve, so that the latter has only to connect the adjacent ends of the suction pipe and allow of a slight freedom of movement, without being exposed to any other strain. One of the flexible connections is at the swivel elbow, and another at about the middle of the pipe, which allows it to drag laterally, either under or off from the hull of the vessel, if it should drift sideways, as the case may be. The drag at the lower end of the suction pipe is of cast iron, and so arranged that if it should encounter any immovable obstruction, it will raise up and pass over it automatically, without unduly straining the suction pipe. The suction pipes are suspended on each side from two steam cranes, with wire rope hoisting tackle, by means of which they are readily raised or lowered to the required depth. A spring indicator on the crane shows the tension of the ropes, and the degree of pressure of the drag upon the bottom. The drag is furnished with two removable steel cutting blades.

From the pumps the discharge is carried forward over the hoppers in two large troughs, which have openings, or slides, at suitable intervals, so that the material can be properly distributed in the hoppers. The discharge of the pumps consists of a mixture of sand and water, the percentage of sand varying from 10% to 40%, according to circumstances. The water overflows from the hoppers through suitable openings, passing over the deck, while the sand precipitates in the hoppers. During the trial the hoppers were filled with water only in 4½ minutes, with both pumps running. This is equal to a capacity of 11,000 gallons per minute for each pump. The capacity of the two pumps, when dredging in sand, is 1,000 cu. yds. per hour. In practice, however, a considerable percentage of it goes overboard with the overflow, especially if the sand be light and slow to precipitate. As a matter of actual practice, a capacity of 4 to 5 loads per day of 10 hours are raised and discharged at sea. The time occupied in opening the valves and discharging the load is 7½ minutes. The vessel is equipped with Providence steam windlass, Chase steam steering gear, Westinghouse electric light system, Huntington search lights, and a full equipment that goes to make up a complete sea-going vessel. The crew's and officers' quarters are ample and commodious, and constructed over the hoppers, and specially designed for a warm climate. The pilot house and bridge are placed forward, as shown in the illustrations. There are two masts, each fitted with derrick booms, arranged for handling the suction pipes and all her own machinery. Complete awnings are provided over both forward and after decks.

Some further details concerning the vessel were given in our issue of Aug. 8, 1895, in connection with an account of her trial trip.

The propelling engines were built by Neafie & Levy, of Philadelphia, Pa., and the hull was built at the yards of Hugh Ramsay, Perth Amboy, N. J. The vessel steamed to her

destination, arriving there Aug. 31. Her trial tests have been satisfactorily completed, and the vessel accepted by the Government. The vessel was built from the designs of A. W. Robinson, M. Am. Soc. C. E., who also designed the pumps, pumping engines, and dredging equipment, which were built at the works of the Bucyrus Steam Shovel & Dredge Co., at South Milwaukee, Wis.

PROPOSED FLOOD PROTECTION FOR WILLIAMSPORT, PA.

In our issue of Feb. 14, 1891, was published an abstract of the report of Major C. W. Raymond, Corps of Engineers, U. S. A., upon an examination of the West Branch of the Susquehanna River, made in connection with the destructive floods of May and June, 1889. A map of the watershed of the West Branch accompanies that abstract.

In April of the present year Major Raymond and Mr. L. Y. Schermerhorn, C. E., presented another report upon the feasibility and possible methods of protecting the city of Williamsport against the injurious effect of floods in the West Branch. We abstract this later report as follows:

The flood of 1889 exceeded in height all previously recorded, and is made the measure of protective requirement, though the flood of 1894 came within 2 ft. of the high-water mark of 1889.

The flood of 1889 arose from an excessive rainfall on the watershed of the West Branch of the Susquehanna River, and it raised the water from 23 to 30.1 ft. above ordinary stages at Williamsport and flooded an area of 1,000 acres within the city limits. Over this area, on a frontage of about 18,000 ft., the river rose to a depth of 12 to 15 ft. on the street fronting the river, and from 6 to 8 ft. over the larger part of the remaining portion.

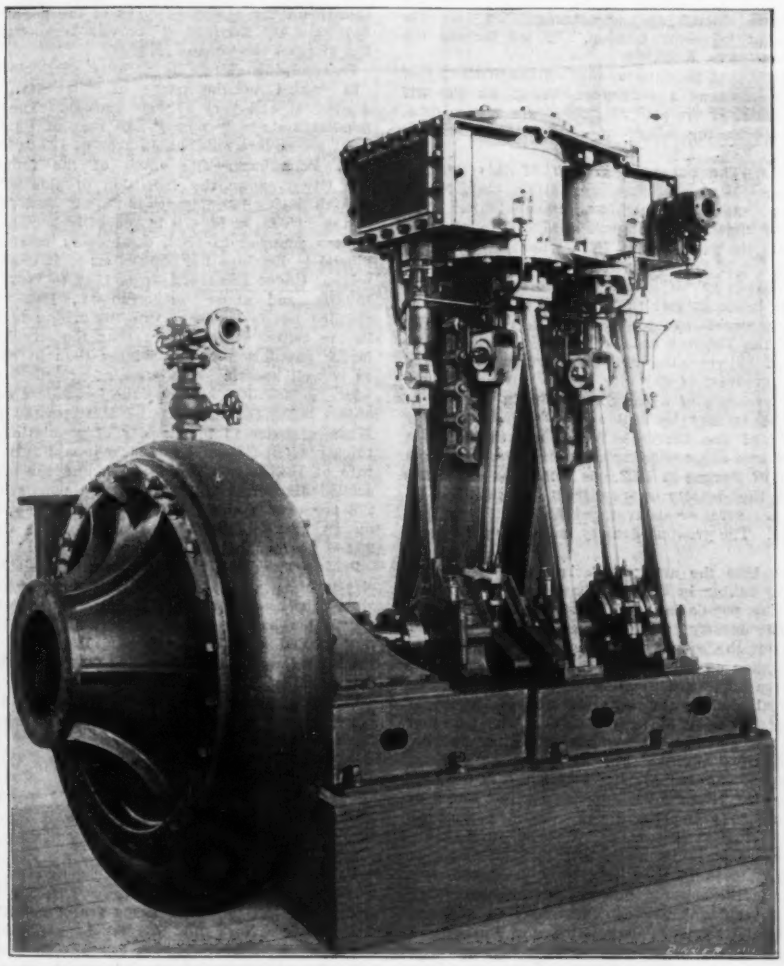


FIG. 2. CENTRIFUGAL PUMPING PLANT FOR U. S. DREDGE "GEN. C. B. COMSTOCK."

After carefully studying the situation, and with the assistance of special surveys and the services of Mr. G. D. Snyder, City Engineer and Secretary of the sub-committee on Surveys and Estimates for flood protection, Major Raymond and Mr. Schermerhorn submitted the following plan of protection, based upon detail given at length in their report:

Any thorough and efficient plan for protection against floods demands the removal of the present Williamsport dam, and the substitution of a movable dam, which can be lowered during floods; the rectification of the river section at the three bridges, by the removal of present abutments and embankments, and replacing them by structures admitting the passage of water; dykes or embankments upon lines described, which practically enclose all the lower portion of the city; the rectification of the mouth of Lycoming Creek, bordering one side of the city; the removal of islands and boom piers within the city limits; the adoption of a comprehensive plan for city drainage, having in view the choking of existing sewers by flood water, and the establishment of a pumping plant capable of keeping the lower district drained during flood periods. A modified plan reduced the aggregate length of embankment, but it would be only temporary, or until the growth of the city demanded the execution of the complete plan.

The sub-committee on flood protection took up the plan submitted and made estimates of cost upon various modifications of the same, which they publish in detail. The cost of the entire scheme, including land on both sides of Lycoming Creek and on both sides of the river, and likewise the removal of all river obstructions, is estimated as follows:

Dikes, pumping plant, etc.	$511,010
Sewers in Williamsport	182,000
Removing river obstructions	123,000
Total	$816,010

This amount, says the committee, seems large, but it is no greater than the cost of the sewerage system which the city has adopted and is now carrying out. It is less than 10% on the valuation of property actually affected by high water, and should be offset by the increased value of such protected property. The committee recommended a commencement of the work on lines costing the city $100,000 and the county $70,000, and hoped to complete the project within three years in its entirety.

Unfortunately Williamsport is suffering from a large debt unwisely contracted between 1860 and 1870, without provision for a sinking fund to extinguish it. This money was expended for wooden pavements that have long ago worn out, and for a system of sewers that is now being rebuilt. The assessed valuation of the city is about $8,000,000, and the state constitution only permits a bonded indebtedness not exceeding 10% of this valuation. The present bonded debt is now over $700,000, and the margin is an exceedingly small one upon which to begin the undoubtedly necessary flood-protection works advised in this report. The citizens, however, hope that some means may be devised for raising the money, even if it be necessary to go to the Pennsylvania Legislature for the necessary special authority, and action upon the report has been postponed until after the next session of the Legislature.

INSULATED WIRES AND THEIR PECULIARITIES.*

The objection to rubber insulation does not come so much from the price—for rubber insulation is now very nearly as cheap as weatherproof—as from the fact that when exposed to the air, or in dry, hot places, it has not the durability or lasting qualities of the braided asphaltum kinds; and it seems to make very little difference as to the grade of rubber one purchases, a well-known brand which has a factory guarantee of 1,000 megohms to the mile, and which is made of the highest grade of gum, not having as good lasting qualities as another and much cheaper wire which is a soapstone and chalk compound, and has only gum enough in its composition to hold it together. Again, most rubber compounds contain more or less sulphur, and in case the insulation becomes broken at cleats or tie wires, a slow but steady corrosion takes place, which is not the case with asphaltum-covered wires.

So well is this known among experienced electrical engineers, that in certain parts of the country they will not use rubber-covered wire unless compelled to. Throughout the South and in many of the Western states this insulation is almost tabooed, the dry air of the Rocky Mountain region being especially trying, while on the Pacific Coast, where it rains from six to nine months in the year, nothing else is used. Asphaltum will not resist long-continued dampness, while it seems to preserve rubber. As long as rubber can be kept away from the air, it makes the best insulation for wires that we have. In moldings it lasts much longer than in cleat or concealed work. Some wires that have been in molding to my knowledge for seven years are still in good condition, due to the fact that the temperature is much more uniform, and that the air cannot circulate freely around them. Wires in conduit would probably last a long time for the same reason.

To my mind an insulation composed of a light rubber core, with two asphaltum soaked braids, or a tape and braid on the outside, would make an ideal insulation for ordinary house-wiring. If you have to use a rubber-core single-braid wire, select one soaked in compound instead of shellac. Never take a wire with tape winding on the outside. Tape is liable to unwind in handling the wire, and loosen up the rubber. Tape-wound wires never last except in molding. Braided wire comes at the same price. It is advisable to select a wire—if of rubber—in which the core is made up of two layers; then if one crumbles or cracks, the other still affords some protection. For cleat work, or concealed work in dry places, use weatherproof wire, if the inspectors will let you. The same applies to conduit, double-tube work.

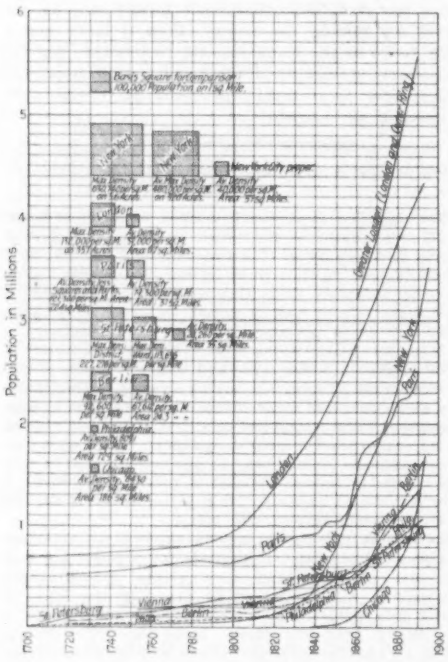
If I were an inspector, I would pass anything that was placed in conduits, even the despised Underwriters' wire, unless in damp places, and I would pass it there, if in iron-armored conduit. The only danger to be feared from this wire is electrolysis. I never knew it to make a short circuit. Some of it on open cleat work has been up for nine years in New York city, and is still good. On porcelain knobs or cleats I can see no objection to it except in damp places. I do not wish, however, to advocate Underwriters' wire for general house-wiring.

* Condensed from a paper by Mr. A. E. Dobbs in the "Electrical Engineer."

GROWTH OF POPULATION OF GREAT CITIES.*

By Elmer Lawrence Corthell, M. Am. Soc. C. E.

In 1886 and 1887 Mr. Rudolph Hering, M. Am. Soc. C. E., who was at that time Chairman of a commission for solving the problem of water supply and drainage of the city of Chicago, compiled some statistics and made a diagram showing the curve of growth of population of several cities in the United States.** About the year 1890, for the purpose of presenting in a professional report on a rapid transit question in Chicago a comparison between the several cities shown on Mr. Hering's diagram, the writer extended the diagram to a more recent date. During the last year he has, by an extended correspondence, obtained the information and plotted on a new diagram the curves of growth of population of several cities of the world numbering over 1,000,000 inhabitants at the present time. These curves have been extended both backward and forward, as will be seen by an examination of the diagram. Many interesting and instructive features are presented by this comparison, and the value of the results thus presented graphically will be at once appreciated by an examination of the diagram.



Growth and Density of Population of Great Cities.

The editor of London "Engineering" (to which this paper is primarily contributed, and by which it is now being published) suggested to the writer during the investigations that it would be still further instructive, and interesting as well, to ascertain and give graphically the comparison of density of population. This has been done as far as it is possible to obtain the information. The squares showing these densities are from the latest census in each case, and may be considered the present density.

The information has been obtained from official sources through the following correspondents, all of whom kindly interested themselves to comply with the author's requests for data, and to whom he is largely indebted for the reliable character of the figures: Mr. James Forrest, Secy Inst. C. E., London, England; Mr. C. O. Gleim, C. E., Corresponding Member Am. Soc. C. E., Hamburg, Germany; Mr. Ernest Pontzen, C. E., also Corresponding Member Am. Soc. C. E., Paris, France; Hon. Clifton R. Breckenridge, U. S. Minister to Russia, and Lieut. Henry I. Allen, Naval Attache, U. S. Legation, St. Petersburg, Russia; Hon. Chas. Denby, U. S. Minister to China, Pekin; Mr. John C. Trautwine, and others in the United States.

As each city has its peculiarities in history, growth, density and many other features, it is necessary to take up each separately, in order that the reader may fully understand and appreciate the curves on the diagrams.

London.—For the information of our readers who are not familiar with the peculiar geographical conditions of the population, the following data need be given in order to have a full understanding of the subject:

London Within Various Boundaries.

	Area in statute acres.
Within Registrar-General's tables of mortality .	74,672
Within the limits of the county of London.....	75,442
London School Board district.....	75,442
City of London within the Municipal and Parliamentary limits	671
Central Criminal Court district.....	269,140
Metropolitan Parliamentary Boroughs (exclusive of the City of London).....	74,771
Met. Parl. Boroughs (including City of London)..	75,442
Met. Police Dist. (not including City of London).	442,750
Metropolitan and City Police districts.....	443,421

The population used in the curve of growth is that included in the Registrar-General's area. It is almost impossible in the case of London, as well as that of other cities, to define the area of the Metropolitan population; that is, the population of the city itself and of the suburban districts which contain the population doing business in the city. The limits of London could be extended far beyond those of the Registrar-General, and with each extension a much different population would be found to exist. To compare, perhaps, more favorably with the other cities and cover the Metropolitan area, it seems proper to state that the population supplied by the London water companies in 1892 was estimated to be 5,490,790, and this population is plotted on the diagram. In 1891 the population of "Greater London," if we include the "outer ring," was 5,633,806.

As to density of population, that of the Whitechapel district is taken as a maximum, being, on the 357 acres included, at the rate of 132,000 per square mile. The average in the whole of London is 37,000 per square mile.

New York.—The curve of growth of this greatest city of the United States is interesting, first, by its comparison with its neighbor, Philadelphia. The curves show that they kept pace with each other very closely from the year 1700 to 1830, when population in New York began to grow with rapid strides, and has continued to do so up to the present time, the ratio of increase being greater than that of any other large city in the world, except Chicago and Berlin. The density of the Tenth Ward, which is on the east side of the city, between the Brooklyn Bridge and Grand St., is the greatest of any city in the world, with the exception, perhaps, of a certain district in the city of Prague; and it may be said advisedly that Sanitary District A, of the Eleventh Ward, has the greatest density of any corresponding area of the world, and twice that of Prague in 1893. It comprises about 320 acres, and the density ranges from 600 to 1,000 inhabitants per acre, or an average of about 512,000 per square mile. The greatest density is 640,000 per square mile.

Paris.—In 1860 the area of Paris was considerably extended by taking in the suburban communes, which increased the population at that time nearly half a million. The density of the population is shown, first, by taking out the squares, or greens and woods, making the average on this basis 121,300 per square mile and the area 22.4 square miles. The average of the entire city, including the squares, etc., is 79,399 per square mile, covering 31 square miles. The curve of growth of Paris brings out several interesting and important historical points. For instance, the city, as is well known, suffered greatly during the latter part of the reign of Louis XVI. and during the Reign of Terror, from 1774 to 1799, during which period the population actually decreased. On the other hand, under the reign of Louis XIV., 1643 to 1715, and that of Louis XV., 1715 to 1754, it greatly prospered, and the growth in the latter period is shown on the curve as having a regular increase. From 1852 to 1870 the Emperor Louis Napoleon did much for Paris, and its growth was very rapid and comparatively uniform. The effect upon the city of the Franco-Prussian War and the Commune is shown plainly on the curve of growth.

Chicago.—This city, on account of its large area in comparison with the population, has as an average only 8,430 inhabitants to the square mile, its area being 186 square miles. In arriving at the population for 1894, it is necessary to use considerable judgment in deciding which census should be employed. There have been estimates made of over 2,000,000, but, to be conservative, the school census of 1894 is used, making the population, including the whole of Cook county, 1,692,727. In ascertaining the ratio of increase, different results are obtained by using different methods of estimating the population, whether by the United States census or by that of the city. The increase from 1880 to 1890 by the United States census was 118%. Comparing the United States census of 1890 with the school census of 1890, the ratio of increase per decade is 106%. If, again, we compare the school census of 1884 with the school census of 1894, we have an increase of 150% per decade.

Berlin.—The census of this city is taken every year, and has been so taken since the year 1720. Consequently, the curve of growth is an entirely different one from that of almost any other city, as the points in drawing the curve are much nearer together on the diagram. As in the city of Paris diagram, so in that of Berlin, the effect of political and military disturbances in the kingdom are plainly seen. The Seven Years' War, from 1756 to 1763, caused a decrease in the population. From 1800 to 1810, an entire decade, there is again a steady decrease, and it was during this period that the battles of Hohenlinden, Jena, Auerstadt, Eylau and Friedland were fought with the French. By the Peace of Tilsit at the end of this period Prussia lost one-half of her possessions and kept the other half under very hard conditions. In 1871 the King of Prussia was proclaimed Emperor of Germany, and Berlin became the seat of the empire. From that time to the present the growth has been very rapid, the ratio of increase from 1883 to 1893 being 37%.

In density Berlin stands next to Paris, the maximum density being 92,000 per square mile, and the average density 67,612, with an area of 24.3 square miles.

Vienna.—The accessible records of population of this city are very incomplete, and the curve of population is made from comparatively few dates. The authorities differ considerably as to the population. The fact that the garrison of the city is constantly changing vitiates the census records.

Philadelphia.—There is nothing particularly striking in regard to the curve of this city. It shows a gradual and very regular growth. The density of population is very nearly like that of Chicago, being 8,091 per square mile, on an area of 129 square miles.

St. Petersburg.—The effect of the founder, Peter the Great, upon the inception of this city and its growth during two decades is plainly seen at the origin of the curve. In fact, it is generally known that, when it was founded in 1703, compulsory means were employed to increase the population to 100,000 during his reign. Under Elizabeth, from 1741 to 1762, it reached 150,000, and under Catherine II., 1762 to 1796, it reached nearly 300,000. One disturbing feature exists in the census estimates in that the city has a much larger population in the winter than in the summer, as is well known. The curve of growth includes this winter population, and also the immediate suburbs, the object being to arrive at the Metropolitan population. With reference to the density of population, the most thickly settled ward has 50,000 inhabitants, or at the rate of 113,636 per square mile, and the most thickly settled district in that ward has a population of 227,276 per square mile. The average for the whole city, on an area of 350 square miles, is at the rate of 28,260 per square mile.

Pekin.—The census records of the poulation of this city are so meager that it has been found impossible to get sufficient data for plotting the curve. The population has decreased regularly since 1797, and is now probably rather less than 1,000,000. Including the immediate suburbs, the area of the city is about 27 square miles.

Recapitulating the statements in regard to ratio of increase at present in the several cities above noted, the following summary is given:

Present Percentage of Increase Per Decade.

London	10.4	Chicago	106.5
Greater London	18.0	Berlin	37.0
New York	33.3	Philadelphia	25.0
Paris	10.0	St. Petersburg	15.0
" av. last 3 decades	12.7		

As the number of houses and the number of inhabitants per house have much to do with the density of population, the following items are of considerable interest: New York has 150,000 houses, averaging 18 residents per house; London has 600,000 houses, averaging 7 residents per house. At the beginning of this century London had only 130,000 houses. Paris has 90,000 houses; at the close of the Franco-Prussian War it had 70,000, and at the close of the Napoleonic wars it had only 28,000. The average number of residents in a Paris house is 25, 40% greater than in New York. The most of the public and office buildings in Paris are utilized also for residence purposes, whereas in New York most of the buildings in the downtown district are used entirely for business purposes. In a square mile of territory between Wall and Spruce Sts. and between Broadway and the East River there were, at a recent election, only 430 voters, representing a total population of about 1,750. The small size of the average Philadelphia dwelling is seen from the fact that whereas its population is only about 1,000,000, it has 187,000 houses.

The facts brought out by the diagram offer material for interesting study, such as the influence of national life upon urban growth, especially upon that of these principal cities; the serious effect of war upon the growth of cities; the remarkable change going on in these countries, by which the great cities are pushing upward their curves of growth; and what is, perhaps, of greater interest still, the quite close approximation that it is possible to make of the time when some of the curves will intersect and the rank in population be

* A paper read before Section I., American Association for the Advancement of Science, at Springfield, Mass., Sept. 3, 1895.

** See Engineering News, Jan. 15, 1887.

* The Metropolitan Police district extends over a radius of 15 miles from Charing Cross—688.31 square miles, exclusive of the "City of London."

changed, some outstripping others and some falling behind their more prosperous competitors.

An approximate estimate may at least be hazarded, predicting the population of the cities under consideration at the end of future decades. Certain important possible changes in conditions need, however, to be considered in forecasting such results, among which are: First, the changes which new methods of transportation may bring about, either taking people more quickly and cheaply into cities or out of them into more distant districts which are now open areas or sparsely-settled country. Second, the congestion or overcrowding of city areas, making them too dense for comfort or health. These two conditions are already producing changes of magnitude in population. London is an instance of these effects, or of some others, possibly; several of the central districts, instead of showing an increase, showed actual decrease in the last two census epochs.

It is difficult to predict now what changes will take place in New York during the succeeding decades by the contemplated transportation changes, such as the opening of the bridge over the East River at Blackwell's Island, the new East River bridge at Grand St., the construction of one of the chartered bridges over the North River, and probably the completion of the North River tunnel, the expenditure of, perhaps, $50,000,000 in new rapid transit facilities; the substitution of electric locomotives and trolley lines for the present railroad locomotives; perhaps even the introduction of high-speed bicycle trains, etc., etc.

As to Chicago, which is the phenomenal city of the world in respect to rapidity of growth, it may be safely assumed that its ratio of growth will continue with no great diminution for two decades at least to come. Precedent, or the history, rather, of great cities, goes to show this, and then its remarkably advantageous position commercially gives additional reason for this belief. Berlin may also be expected to grow with great rapidity for at least two decades more. As the seat of a new empire, it is still young, strong, vigorous and ambitious. In addition to all other reasons for the continuance in rapid growth of the above-mentioned cities, there must be taken into account that of the modern tendency to gravitate to great centers of population, which modern methods of transportation have accelerated.

Even with the above problematic conditions disturbing the future, there is sufficient ground on which to rest a prediction of population, which the author has the temerity to make, as follows:

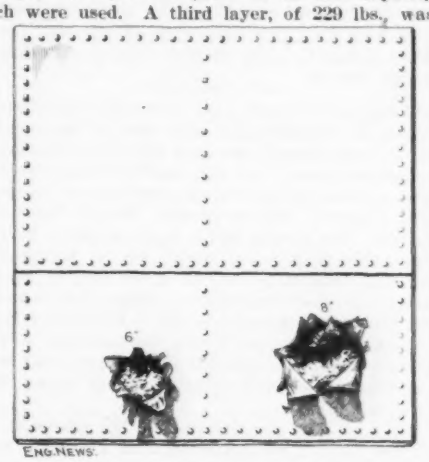
City.	Est. pop. in 1900.	Est. pop. in 1910.	Est. pop. in 1920.
Greater London	6,496,000	7,470,400	8,516,256
London	4,599,800	4,967,784	5,315,528
New York	3,900,000	4,953,000	6,191,250
Paris	2,697,300	2,967,030	3,234,063
Berlin	2,101,400	2,731,820	3,496,729
Chicago	2,400,000	4,560,000	8,208,000
Philadelphia	1,414,500	1,697,400	2,002,932
St. Petersburg	1,185,600	1,339,728	1,500,495

CORN-PITH CELLULOSE FOR WARSHIPS.

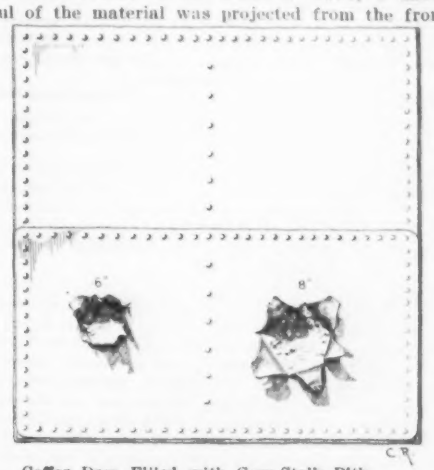
The cocoa cellulose used for packing the cofferdams of warships, with the view of rapidly closing up shot holes and excluding water, is made from the fiber of the cocoanut husk, and is usually mixed in the proportion of 14 parts of the granular, or ground, fiber, to 1 part of the whole fiber. When used in the cofferdams of warships, it is packed loose and compressed by jackscrews or other appliances. It has the property of swelling enormously when wet, and when set on fire burns slowly and without a flame. It has been used considerably abroad, and to some extent on our own warships.

Recently Mr. Mark W. Marden perfected a process for making a cellulose, or material even more suitable for the purpose intended, out of the pith of corn stalks. Secretary Herbert, of the Navy Department, ordered a test of this American product at Indian Head, using two cofferdams originally constructed at the Norfolk Navy Yard in 1892 for tests of the cocoa cellulose. These cofferdams were made of steel and were 6 ft. high and 6 ft. wide by 3 ft. deep. The front plating was ⅜ in. thick and the rear plating 3-16 in. thick. The dam intended for loose cellulose was fitted with two manholes in the top; the one intended for cellulose in waterproof bags had but one manhole. All manholes were oval, 23 × 11 ins. These cofferdams were placed on heavy timbers lengthwise, with similar timbers above, and the two sets of timbers were tied together by chains.

On June 10, 1895, the above-described cofferdams were repaired and made ready for comparative tests of cocoa and corn-pith cellulose. The materials were packed as in the cocoa tests of 1892, as follows: A layer of mixed cellulose of uniform thickness and weighing 283 lbs. was first put in the bottom of the cofferdam and uncompressed; this layer was 2 ft. thick. A double layer of 2-in. planks was then placed on top of the cellulose, with one set of planks at right angles to the other. Finally, by means of jackscrews, the cellulose was compressed to 18 ins. The second layer, of 231½ lbs., was then put in and compressed, as before; but as the jackscrews were not powerful enough, two hydraulic jacks of 15 tons capacity each were used. A third layer, of 229 lbs., was introduced, and when compressed the thickness of the three layers was 4 ft. 8 ins. A fourth layer entirely filled the cofferdam, and brought the total weight of the cellulose employed up to 832 lbs. It took a gang of eight laborers 1½ days to finish this packing.



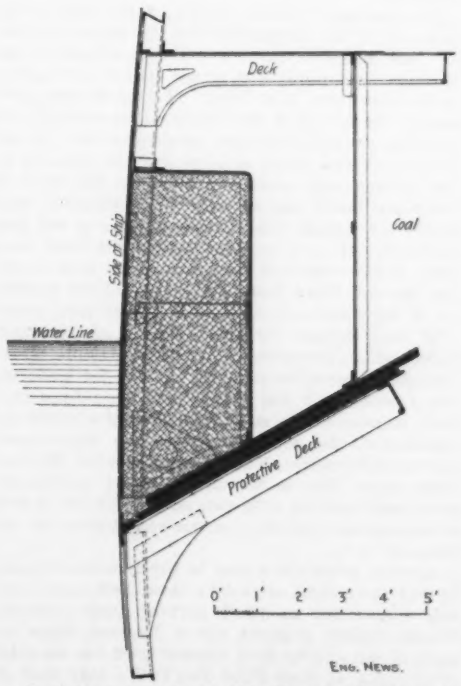
Coffer Dam Filled with Cocoa Fiber.



Coffer Dam Filled with Corn-Stalk Pith

COMPARATIVE TESTS OF COCOA FIBRE AND CORN-STALK PITH FOR FILLING COFFER DAMS. MADE BY THE U. S. NAVY DEPARTMENT AT INDIAN HEAD PROVING GROUNDS.

The testing board was headed by Naval Constructor Linnard, and the inventor, Mr. Marsden and Mr. A. J. Ostheimer, representing the Franco-American Cellulose Company, were present at the date mentioned. One cofferdam was packed with



Half Section of Battle Ship Showing Position of Coffer Dam.

832½ lbs. of cocoa cellulose, mixed in the usual proportions and having a density of 7.7 lbs. per cu. ft. The other cofferdam contained 702 lbs. of corn cellulose, with a density of 6.5 lbs. per cu. ft.

The cofferdam containing the cocoa cellulose was first pierced by a 100-lb. shell loaded with sand, with a firing velocity of 1,000 ft. per second. The shell, of course, passed completely through the cofferdam, leaving ragged holes in the plating. Water reached the level of the hole at 12:27 p. m., and at 12 h. 37 m. 15 s. p. m. the first drop appeared at the rear of the cofferdam. The box was filled with water a third time, showing a flow of somewhat less than ½ gallon per minute.

Meanwhile the cofferdam with corn cellulose had been pierced by a similar 100-lb. shell, fired at a range of 314 ft. and a velocity of 1,000 ft. per sec. As in the case of the cocoa cellulose, a handful of the material was projected from the front and rear of the dam. Water was turned on as before, and reached the level of the cofferdam at 12 h. 53 m. 30 s. p. m., and was at the top at 12 h. 54 m. 30 s. p. m. At 2 h. 24 m. 30 s. p. m. the water was drawn off for further tests, the hole having remained under water 1½ hours. During that time no water appeared at the hole in the rear of the dam, nor at any time did the corn cellulose become damp.

The cocoa cofferdam was then penetrated by an 8-in. sheel, loaded with sand, and weighing 250 lbs., the hole being 4 ft. 11 ins. below the top of the dam and on a line with the first one. About 1 lb. of cellulose was projected from the front hole, and about two quarts from the rear hole. Water was then turned on and reached the level of the hole at 2:36 p. m., and 25 seconds later a few drops appeared at the rear hole. The flow gradually increased, and the first box, used to catch the leaking water, was filled in 30 minutes, and the second box filled in 18 minutes, showing a steady rate of flow of 1½ gallons per minute. The first 6-in. hole made allowed the water to come through as before during this period.

The cofferdam filled with corn cellulose was then penetrated by an 8-in. shell under similar conditions of range, weight and velocity, and water was turned on. The water reached the level of the hole at 3 h. 19 m. 40 s. p. m., and touched the top one minute later. The water stood at this height 45 minutes after reaching the level of the shot-hole, and was then drawn off. None of it appeared at the rear of the dam, nor was the cellulose damp at that point. No water appeared at the original 6-in. hole, and the cellulose was also dry at that point.

To test the non-combustible qualities of the two materials, a portion of the cellulose was placed in an iron chest and a 3-lb. shell, containing 1-10 lb. of powder, was exploded in it. This experiment was repeated twice, with the result that the cocoa cellulose burned, while the corn cellulose was only charred.

As a result of these tests, Secretary Herbert has ordered the corn cellulose to be used on the two new warships, Nos. 5 and 6.

It should have been mentioned that the steel cofferdams used in the above tests were placed inside of wooden boxes, so arranged that the openings left for the shots could be closed for the water-test. The illustrations show the rear of the dams containing the cocoa and the corn cellulose after the two shots were fired, and a general plan of the method of applying the cellulose cofferdams to warships.

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The value of street railway franchises when properly handled by cities is well illustrated by the revenues received by the city of Toronto during the 3½ years ending Dec. 31, 1894, which aggregated about $425,000. That city in 1891 bought all the street railway lines within its limits at an appraised valuation of $1,453,788. After operating the system a few months the city sold it, practically at cost. The purchasing company accepted a 20-years' franchise, the same to be extended to 30 years if authority to that end could be secured by the city. For this franchise it agreed to pay an annual rental of $800 per mile of track, on a single-track basis, and in addition the following percentages on the gross receipts of each year:

	Per cent.
Up to $1,000,000 per year	8
Between $1,000,000 and $1,500,000	10
" 1,500,000 " 2,000,000	12
" 2,000,000 " 3,000,000	15
Above 3,000,000	20

The franchise prohibited the operation of the road on Sunday until such time as the people should declare in favor of it by a popular vote. It provided for fares of 5 cts., with free transfers to any part of the city, and night fares (from 12 until 5:30) of 10 cts.; it further provided for the sale of eight tickets for 25 cts., good on day cars until 8 a. m. and from 5 to 6:30 p. m., and for other tickets, good any time during the day, at 25 for $1, or six for 25 cts.; besides these, school tickets are sold for use between 8 a. m. and 5 p. m., five days in the week, at 10 for 25 cts. The hours of labor on the system are limited by the franchise to 10 a day. The company agrees to add 2 per cent., right through the scale, to its payments on gross receipts if it is at any time released from its obligation to sell eight tickets for 25 cts. for use during the hours named above.

Through the kindness of Mr. E. H. Keating, City Engineer of Toronto, we are enabled to present the revenues received each year by the city for this franchise, as follows:

Year.	Rentals on mileage of tracks.	Percentage gross receipts.	Total.
1891*	$18,135	$22,867	$41,102
1892	55,134	65,239	120,373
1893	56,340	72,235	128,575
1894	58,170	76,386	134,556
Totals	$187,779	$236,827	$424,606

* Sept. 1 to Dec. 31, only.

Of course, Toronto is a large city, its population by the Canadian census of 1891 having been 181,220, but how many of the 17 cities in the United States with as great or greater populations in 1890 are receiving anything like the above revenues from their street railway systems? A few cities are receiving trifling sums, but generally the amounts are beggarly, while in most of our municipalities, great and small, nothing is being received from railway franchises beyond a possible insignificant car license or similar payment. It is high time that the value of all such franchises should be recognized by taxpayers and municipal officers.

The project to reduce the time of a transatlantic voyage by establishing a new port at the eastern end of Long Island, has been agitated at intervals for several years; and Mr. Austin Corbin has become well known as either its originator or its principal promoter. In the current "North American Review," Mr. Corbin has a paper in which he explains this project and points out at length the numerous advantages which, in his opinion, would make this new departure a commercial success. Mr. Corbin's proposal is to make Fort Pond Bay, just west of Montauk Point, the terminus of the Atlantic voyage on this side of the water, and Milford Haven, the most westerly port of Wales, the other terminus.

We may pass for the present his advocacy of Milford Haven, as compared with Liverpool and Southampton, and review his arguments for Fort Pond Bay. He compares the time which could be made from the New York postoffice by the present route and by the Fort Pond route, and finds a saving of 3 hours and 56 minutes in favor of the latter. But in this estimate he makes no allowance for the delay necessary for transferring passengers, baggage and mails from the steamer to the train at Fort Pond Bay; and further, he estimates an average regular rate of 60 miles per hour for the train from Fort Pond Bay to New York. Mr. Corbin must know that no regular train in the world makes such fast time as this over so considerable a distance; and the Long Island road, with its crowded suburban traffic, is by no means a favorable place to try such an experiment.

But the most serious defect in the scheme appears to be the assumption that the saving of three or four hours in time would counterbalance the obvious disadvantages of a port distant over a hundred miles from New York. To the average passenger the saving of three hours' time would be as nothing compared with the inconvenience of a rail journey of two hours or more and the transfer to the steamer. At present a cab from his hotel or residence lands him at the wharf with his baggage; his friends come to the steamer to bid him farewell. He can at once deposit his hand baggage in his stateroom, and then go on deck to enjoy the sail down New York's magnificent harbor, or, if the vessel sails at night he can at once retire. The fact is that the great volume of passenger travel which patronizes the modern Atlantic greyhounds is travel for pleasure and not for business; the crowds seek the "Paris" or the "Lucania," first, because of the magnificent luxury of their appointments, and second, because they are famous as record-breakers. The actual saving of three or four hours' time in six days' journey counts for practically nothing with nine passengers out of ten, in comparison with the comfort and pleasure of the passage.

Another point which may be barely touched upon, is that the freight carried by these fast ocean vessels counts for no small part of their revenue. Would freight shippers add a hundred miles or more of rail haul to their steamer tariff for the sake of shipping at Fort Pond Bay? We fear that if Mr. Corbin is to make a success of his project he will have to at least transfer the traffic from New York to Fort Pond Bay over his railway for nothing.

The picturesque engraving of a concrete arch bridge at Stockbridge, Mass., which appears on page 306 of the present issue, will attract attention, we hope, to the merits of structures of this class for parks and city suburbs, where aesthetic considerations are of importance. The heavy cost of stone masonry in this country has made good examples of masonry arch construction comparatively rare. The typical American bridge is the metal truss, or, in recent years, the plate girder; but while we excel all other countries in the design and manufacture of structures of these types, it is undeniable that the lines of the truss or girder are never so pleasing to the artistic eye as those of the arch.

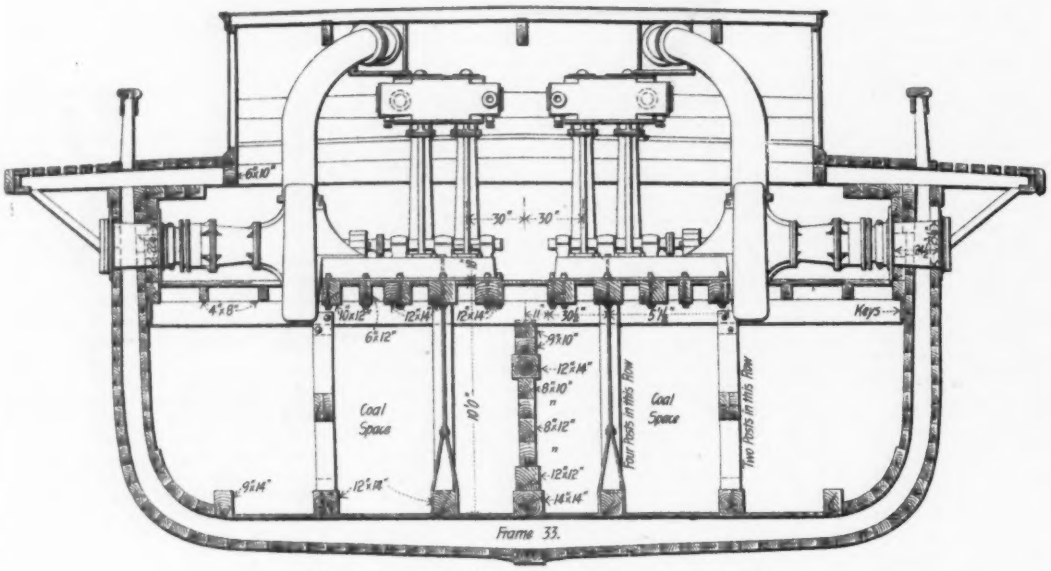
In Europe, where engineering proceeds always on more conservative lines, the arch has been largely adhered to for spans within its limits; and by the use of a combined steel and concrete construction, the cost has been reduced to a figure which compares very favorably with the cost of an all-metal structure, when the superior strength and durability and small cost of maintenance of the arch are considered. It seems extremely probable that coming years will see a much more extended use of the arch in this country. Its adoption in places where its aesthetic merits recommend it will probably lead to a more just appreciation of its value as a railway bridge for spanning narrow openings.

The failure of the recent attempt to sell the right to use the sewage of Salt Lake City for irrigation should give rise to reflection on the part of those who are always deprecating the waste caused by discharging crude sewage into streams. It has long been maintained that millions of dollars are being wasted annually in this country through the failure of our cities to utilize the vast amounts of fertilizing materials which are annually carried to the rivers, lakes and oceans by our sewers. A few of our cities have been forced to adopt sewage purification in order to protect either their own or their neighbors' noses and water supplies (more generally the former, although in scores of cases the latter is greatly needed). But the instances where any of these cities has derived any revenue or has diminished the cost of disposal on account of the value of the matters carried by the sewage are exceedingly rare. The sewage of a number of Western towns is used for irrigation, but in nearly every instance the city pays for the disposal of the sewage even under these circumstances, although, of course, the payment may be smaller than otherwise, because of the use to which the sewage is put.

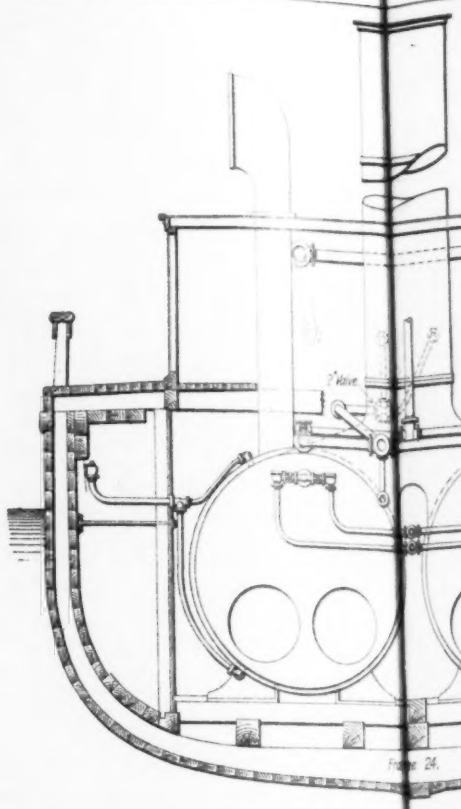
Coming now to the experience of Salt Lake City, it appears that the gravity outfall sewer described in our issue of Jan. 4, 1895, is now about ready for use. It has been built with a view of utilizing the sewage for irrigation, and the city owns 75 acres of land at its mouth. This summer the city advertised for bids for the use of this sewage, including also the land owned by the city. The idea was that proposals would be made to pay the city a yearly sum for the sewage and land, the bidders using the sewage on the city land and making arrangements to put it on other land in the vicinity. The date for receiving bids was postponed two or three times. Finally, the bids were considered and it was found that only one had been put in, and that one demanded payments from the city. The bidder offered to take care of the sewage for five years at $5,000 a year; for 10 years at $12,500, and for 20 years at $15,000 a year.

It is never safe to jump at conclusions, so it must not be thought that the sewage of Salt Lake City may not yet bring the city a return, diminishing to some extent the cost of disposal. It is probable, though, that the city will be obliged to go farther in the matter before securing a market. It may have to extend the sewer and seek individual consumers, just as an irrigation company would dispose of its water. Or the city may even find it necessary or advantageous to buy or rent more land and go into the sewage farming business.

Accustomed to clear mountain water for irrigating purposes, the people of Utah, or of other sections where irrigation is practiced, must be educated to and in the use of sewage. Naturally, they look upon it with doubt, and having wrong and exaggerated views of the character of city sewage, think it unfit for watering crops, and are doubtful as to its final effect in clogging their soil. To teach them the error of their opinions and just what can be done with sewage and just how to do it, must



CROSS SECTION SHOWING CENTRIFUGAL PUMPS.



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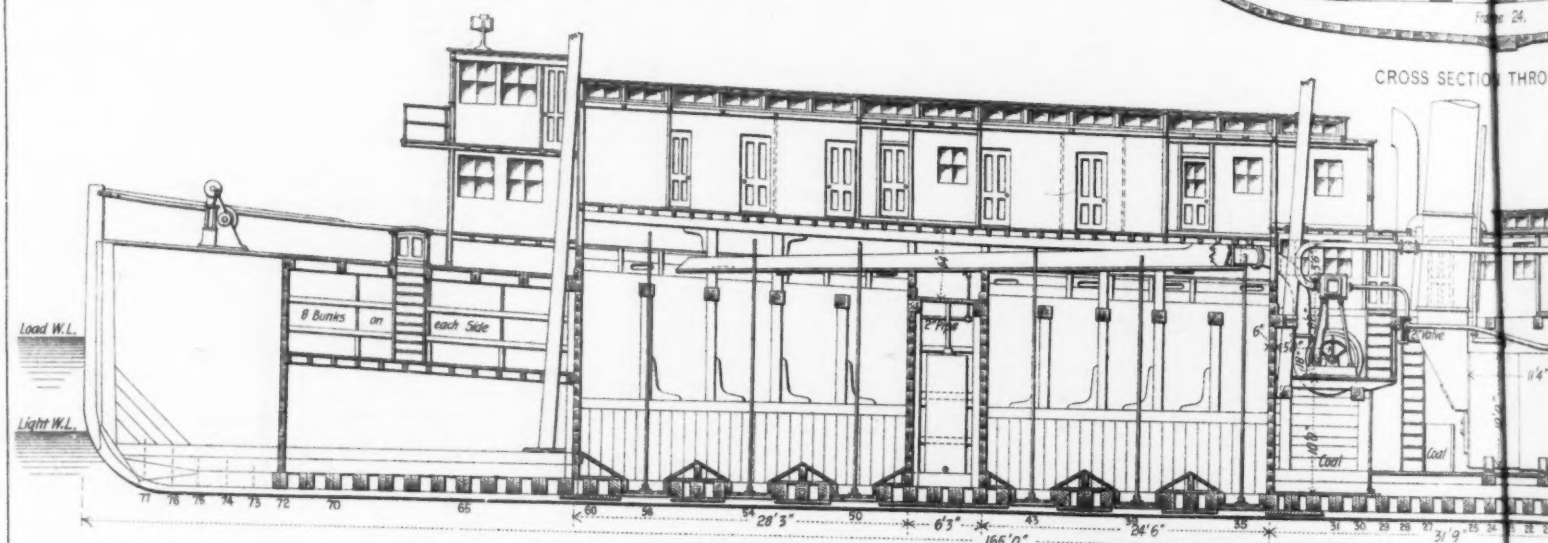
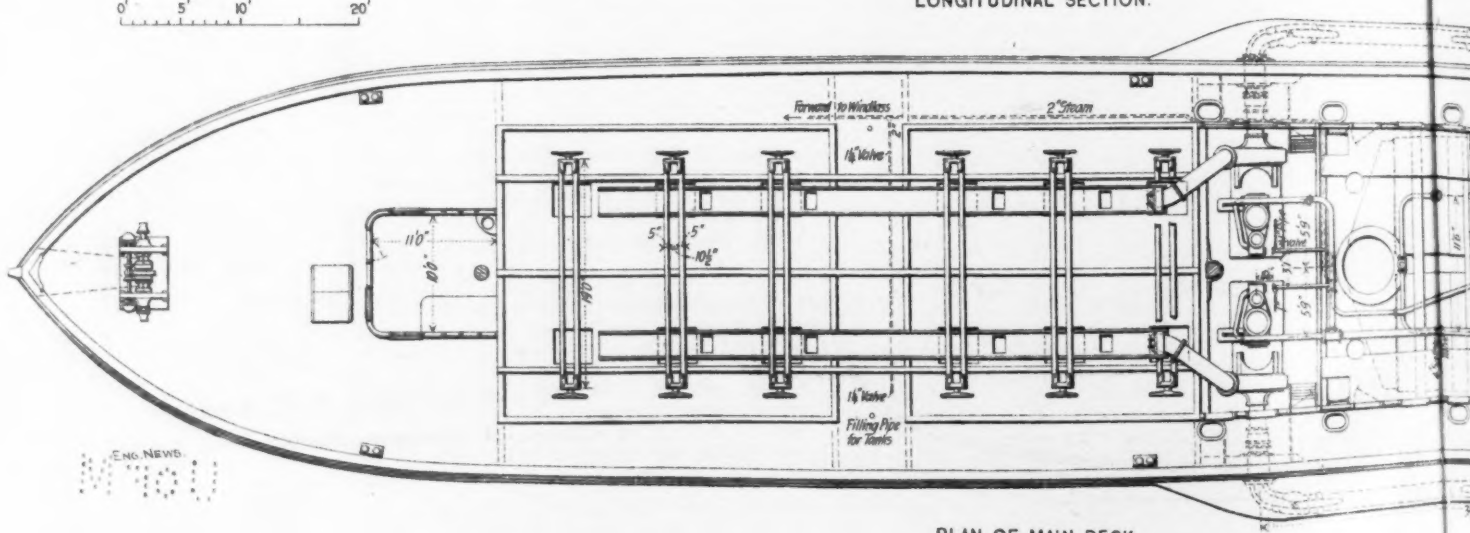
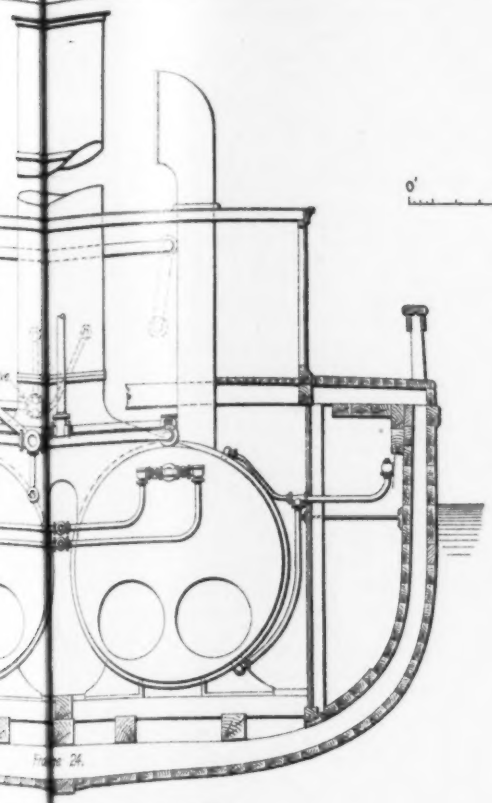


LONGITUDINAL SECTION.

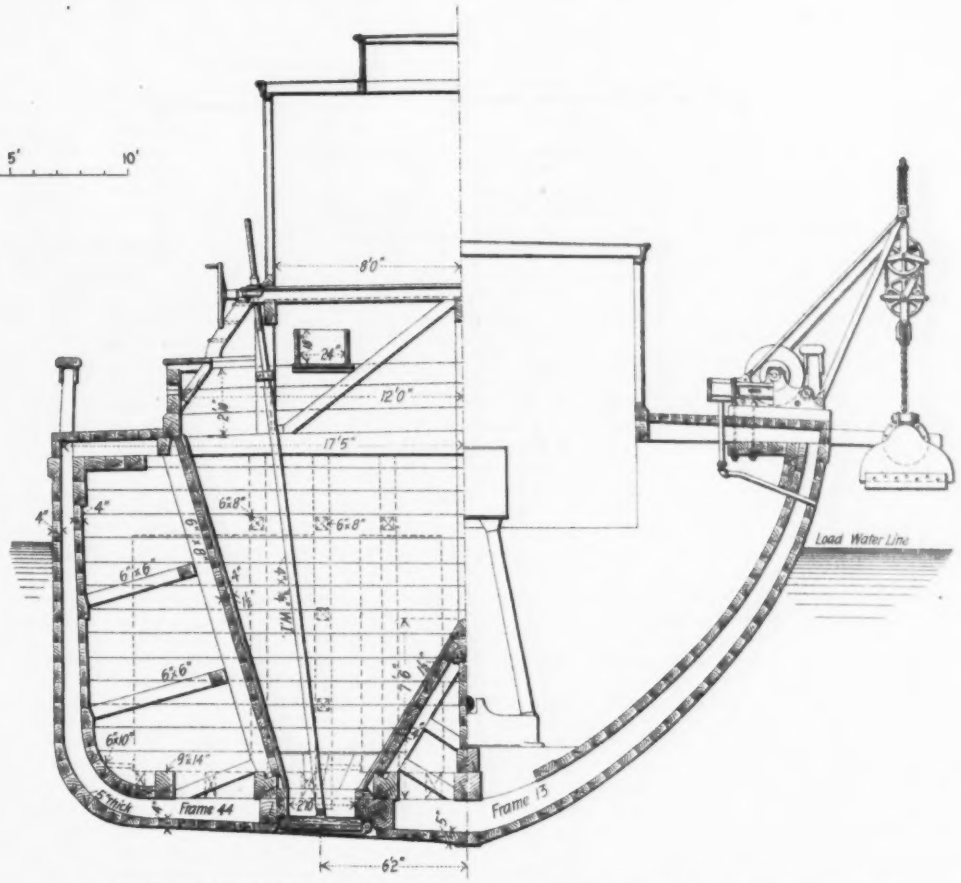


PLAN OF MAIN DECK.

ENG. NEWS.

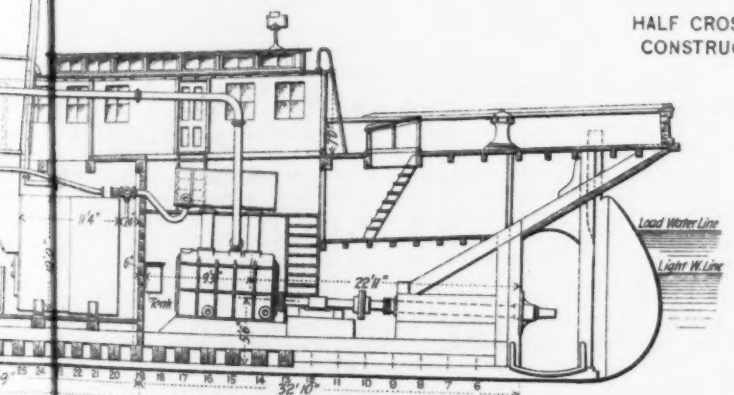


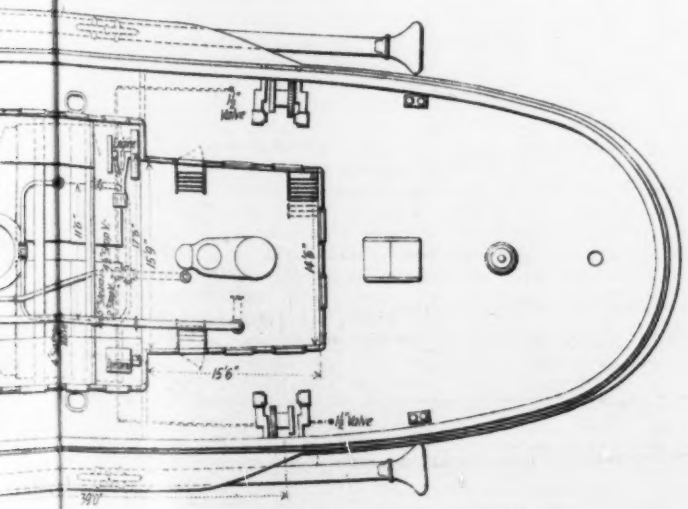
SECTION THROUGH BOILERS.



HALF CROSS SECTION SHOWING CONSTRUCTION OF HOPPERS.

HALF CROSS SECTION SHOWING METHOD OF SUSPENDING SUCTION PIPES.





HYDRAULIC DREDGING STEAMER "GEN. C. B. COMSTOCK."

Built for the Galveston Harbor Improvement
by the
Bucyrus Steam Shovel & Dredge Co.,
South Milwaukee, Wis.

Hugh Ramsey, Perth Amboy, N. J.,
Sub-Contractor for Hull.

A. W. Robinson, M. Am. Soc, C. E.,
Designing Engineer.

Major A. M. Miller, U. S. Engineer,
in Charge of Galveston Harbor Improvement.

CHAS. HART & SONS, LITH., 32 VESEY ST., N. Y.

be a work of patience and tact on the part of the cities concerned. The work must be carried on under the direction of men of skill and experience, and must be conducted on business rather than political methods. The results are likely to be disappointing, if much in the way of revenue is expected; but if wisely carried on, such enterprises should eventually contribute in a very material way to lighten the burdens of sewage purification, especially in the West, where water is so valuable.

In publishing the illustrations of the valves and gates for the U. S. lock at Sault Ste. Marie, in our issues of Oct. 10 and 17, it was stated that the Detroit Bridge & Iron Works were the contractors for the work. We are now informed that this was an error and that the contractors for the work were the Variety Iron Works, of Cleveland, O. Our apologies are tendered to this firm for the mistake. In the same series of articles in our issue of Oct. 31, it should have been stated that the Southwark Foundry & Machine Co., of Philadelphia, were the builders of the centrifugal pumps which are used for draining the dock.

MODERN TRANSPORTATION FACILITIES AND THE GROWTH OF CITIES.

The paper of Mr. Corthell in this issue, upon the "Growth of Population in Great Cities," is suggestive of many future problems in finance, in engineering and in municipal control, compared with which the undertakings of the present will seem insignificant. It is not our purpose to speculate upon the causes of this tendency towards concentration of population, as it would carry us into too broad a field, but we do see in this centralization plenty of work for engineers, and problems which it will require their best efforts to solve. Furthermore, this centralization is a direct outcome of, and accompanies the development of transportation facilities within the present century; and the greater growth predicted by Mr. Corthell necessarily means a still further extension of these facilities. It would not be possible without it. Take the Greater New York of 1920, for example, and attempt to figure out what it means to transport about their daily business or pleasure 6,000,000 or more of people, from fields, factories and mines, and the food, fuel and other supplies which they will require.

Leaving out of account the crowded cities of ancient history and the abnormal social conditions which created them, it is only well within the nineteenth century that the massing of population into great cities has been a possibility. The improvements in highway construction made by Macadam and Telford were the first step toward the creation of better transportation facilities and means of intercommunication; these improvements at once extended largely the radius from which a city might draw its food supply, and gave the first impetus to the growth of the great modern industrial centers.

The Romans well understood the importance of transportation facilities in the maintenance of their military centers, and their areas of conquest can be traced, after the lapse of 2,000 years, by the remains of their roads. After the turnpike era came the railway, and it has grown in importance and in ability to move a vast traffic cheaply to an extent which few understand. Still more recently—within the last decade, in fact—electric traction has grown to be a formidable rival of the steam locomotive for light, short-haul traffic. Within the boundaries of cities the street railway of a half-century ago, with horses as a motive power, met the demand for passenger transportation that has well served its day. Heavy traffic, steep grades and the demand for higher speeds brought first cable traction and then the electric motor into the same field. As a rule, in American cities, these transportation facilities keep in advance of the population. People will not fill up a suburb until it is placed in close communication with the center. In the Greater New York, if the population which Mr. Corthell prophesies in 1920 is reached, a vast expansion of the present traffic facilities must be made, and to a large extent must be kept in advance of the traffic it is meant to carry.

In the future great cities, even more than in the cities of the present day, the centrifugal tendency will be manifested. As business becomes more centralized, residences in cool, healthful suburbs will become more and more in demand, especially as more rapid transit facilities bring these suburbs practically closer to the center. And a fact not often appreciated is that the area made available for residence is enormously greater as the distance from the center is increased. The limit of New York's suburbs, for example, may now be taken as struck by a radius of, say, 12 miles from the City Hall. Now, if more rapid transit makes the territory between 12 and 16 miles as near in point of time as that between 8 and 12 miles now is, an area is added to the territory available for suburban residence which is nearly 1½ times as large as that between the 8 and 12-mile circles. In this fact lies the strongest argument in favor of putting into execution, as speedily as possible, the plans for further rapid transit routes in and about New York city. But in laying down and constructing these lines, due consideration must be given to provisions for the further and broader extensions that we must have before the real Greater New York is possible.

In the transportation schemes for the greater city of 1920, the East River and the Hudson will disappear as boundaries, and for all practical purposes the metropolis of that day will include large areas of Long Island and eastern New Jersey. This means bridges or tunnels, and plenty of them, and again abundant work for the engineer. The call for a bridge over the Hudson is already apparent, and has brought out plans for the unprecedent span of 3,100 ft. Capital is as yet shy of investment in such colossal bridges, but there is no lack of it to be had, and as soon as the prospective revenue will warrant the expenditure they will be built. We will soon have two, and possibly three, bridges over the East River, the old Brooklyn Bridge, the new bridge at Grand St., and, it is to be hoped, also the Blackwell's Island Bridge for the Long Island R. R. East River tunnel schemes are still agitated, and the actual successful driving of one tunnel for commercial purposes has outlined the difficulties to be met with. All these, taken in connection with the projects for crossing the Hudson, are quietly preparing the way for the population that is yet to come.

As to the exact detail and operation of the future system of transport in New York, we may be said to be in a transition stage. Steam, which had its beginning on the elevated system, will doubtless be superseded by electric power, both for underground and future elevated service. The experience in Chicago and Liverpool is showing the general economy of the new motor for elevated service, and no one can foretell the next step in the cheaper generation of the electric current and in its transmission to greater distances. The ability to send single or double-car trains at very short intervals, without smoke or dirt, and the centralization of power generation are great points in its favor, which even now almost overbalance the waste in obtaining useful effect from the coal consumed.

Rapid transit properly belongs to routes so situated and operated that there will be no interference with them by ordinary traffic, for unusual speed is demanded. But rapid transit of a secondary type is being now applied to surface roads, by cable and electric power; and as feeders to the faster trunk lines and as means of more quickly moving over short distances and across the city, their further development is a necessity. The present outlook would seem to indicate that cable traction will not figure largely in this extension. If New York still adheres to its prohibition of overhead trolley wires on Manhattan Island, some form of electric conduit system, or isolated conductor system, like that controlled by the Westinghouse Co., seems likely to supersede both horses and cables at any early day.

Assuming that adequate and cheap transportation is the first important step in the creation of the future Greater New York, and that the electric current will play a large part in furthering this end, some other problems foreshadowed by this massing of population may be glanced at. Until recently, legislation and engineering in most American cities have been defective in looking too much to present and too little to future necessities. But the very rapidity of growth and the massing of population have forced a change in policy, and many large cities are now attempting to undo the blunders of preceding administrations, and are at last making provisions for present health and future growth.

Boston is, perhaps, taking the broadest view of the situation in the creation of its Metropolitan District and in the generalization of its schemes for drainage and water supply. Chicago is spending millions in digging a canal to carry away the filth that now endangers the purity of its lake water, and this canal promises to have an interstate, and even an international, interest not foreseen by its projectors. Aside from its new aqueduct and the storing of more of the rainfall on its Croton watershed, New York is actually doing nothing just now looking towards its larger estate. It is planning many things, it is true, but the first decisive step is yet in the future.

But, in a minor degree, we can see in many different parts of the country the effect of more people crowding into a given area than was the case a few years ago. Sewage that once went into the nearest stream must now be disposed of on more scientific principles, and water, once pure and abundant and near at hand, must be gathered and brought from greater distances. In our great cities the sanitary conditions are being more carefully looked into, and greater precautions are found absolutely necessary to preserve the public health. While some, even large, cities are slow to recognize the altered conditions, and continue the wasteful methods of a generation now past, the general tendency is towards a healthy change in practice and a wiser provision for the near future.

LETTERS TO THE EDITOR.

GRAVITY AND SPRING NUT LOCKS.

Sir: In your issue of Oct. 3 we note the very interesting and valuable diagram showing the results of a year's tests on various locking devices for track bolts. Probably this series of tests was the most scientific and exhaustive ever made, and also the most impartial, for Mr. Hayward, as a student, can fairly be supposed to have had no prejudice in favor of any special device.

Having given us the actual measure of the power expended in putting these devices into use, and the percentage of their efficiency at the end of a year's work, it is to be regretted that he did not also furnish us with data showing the amount of deterioration, as the result of the year's work, for manifestly that device is most economical, and hence best, which shows the slightest wear, other things being equal.

It is evident at once from the diagram that some locking device is needed, for the ordinary bolt showed only 35% good at the end of the year, and the Harvey grip bolt, whose threads are supposed to take the place of any lock, did little better, showing nearly half loose from the year's work.

Following up the list from these bolts, and omitting the inner check nut and Servis washer, we find 12 kinds of inside spring washers with an average efficiency of 88%, and one outside gravity lock with a record of 100% in efficiency.

Here are two distinct types of locks: one going inside the nut, and dependent on its inherent quality of resilience, the other going outside the nut, and acting by gravity. There can be claimed at the outset an advantage of 12% in efficiency in favor of the outside class, and had the investigation been carried to an examination of the condition of the locks at the end of the test, the advantage in favor of this type, in regard to deterioration, would doubtless have been even more marked.

By a coincidence, in the column next that containing Mr. Hayward's report, is the recommendation of the New England Roadmasters' Association on the subject of nut locks, and, while written with the spring washer in view, it may be of interest to note whether the conditions set forth are fulfilled by a type of lock which the tests show possesses 12% greater average efficiency. The requirements are for a lock nut which:

(1) "Will not catch in the hole of the joint fastening when being used." Can any better way be devised to gain this end than to put the nut between the lock and angle plate (where it belongs), for it then, also, gives the nut a direct, full and even bearing on the splice?

(2) "Will not rotate with the nut." As this does not refer to loose bolts, it must mean a lock which will not

rotate with nut when nut is being tightened up or removed. Surely this result can best be obtained by using a lock which goes on outside the nut, and can be put on after the joint and nut are tightened up, or removed before the nut is.

(3) "Will not injure thread of bolt or nut." This can only be accomplished by using a lock tapped to fit the thread of the bolt.

(4) "Will retain its spring after nut is loosened, all being dependent on the proper quality, hardening and tempering of the steel." Presumably with a view to re-using the lock. Here Mr. Hayward fails us in the matter of data, but it is certain no spring, however good in quality or well tempered, when subjected to its greatest strain and constant hammering at the same time, will retain its resilience. Further, that uniformity in the quality and tempering is expensive and uncertain, and that the end desired can only be attained by the use of a lock which is independent in its action of any spring, and the attendant difficulties of proper hardening, tempering, etc.

(5) "A double spring nut lock." While this may, and doubtless does, fill some points of the requirements named better than a single spring, it retains all the bad points of a spring, and the diagram given by Mr. Hayward shows its efficiency to be 80% only, or 8% less than the average for the spring class of washer.

Ira Abbott.
Young Nut Lock Co.

New York city, Nov. 1, 1895.

NOTES AND QUERIES.

J. M. L. submits a question of "overhaul" in contract work. The specifications say that "an allowance of 1 ct. per cu. yd. shall be paid for each 100 ft. hauled over an extreme haul of 500 ft." In this case the contractor has hauled his material 510 ft. from the face of the cut to the "dump," and he questions as to where the extra compensation begins.

As the wording of the specification practically follows the form used for the last 25 years, and as the question is one causing frequent discussion between engineers and contractors, it would be well to attempt to fix some standard of practice. Under the strict interpretation of the above specification, the contractor would be compelled to haul his earth 599 ft. "free," though an "extreme haul of 500 ft." is fixed. On the Philadelphia & Reading R. R., some years ago, the Division Engineers were instructed to interpret a similar clause as "100 ft., or any considerable part thereof," and the departure was usually made at 33 ft. and over. To attempt to subdivide the 1 ct. into 100ths, or 10ths, in figuring payments due, introduces a complication that costs more than it is worth, as a rule. It is evident that the usual form of specification needs overhauling on this head, and it would be interesting to hear of "later practice."

H. F. asks for information on the method of making cinder paths for bicyclers, built alongside of highways.

We shall be pleased to hear from any of our readers who may have had experience in this work.

L. H. Y. asks for a formula for a cement to fasten paper coverings on pulleys, to prevent belts from slipping.

We have not been able to find a formula for a cement for this special purpose. Cooper's "Treatise on Belting," p. 107, says the application of leather to a pulley is very simple and easy, and may be done by means of glue by any intelligent workman. On p. 95 he mentions a mixture for covering pulleys, composed of three parts of glue, made up with vinegar, to which is added a teacup full of Venice turpentine.

THE SCHUERMAN COMPUTER.

Prof. W. H. Schuerman, Dean of the Engineering Department and Professor of Civil Engineering in Vanderbilt University, Nashville, Tenn., has devised an ingenious mechanical computer for performing all kinds of arithmetical and trigonometrical calculations rapidly, and with sufficient accuracy for the purposes of engineers, surveyors, architects, etc. The computer is based upon the principle of logarithms, though a knowledge of logarithms is not necessary for the solution of the majority of problems with the instrument.

The computer itself is a heavy card carrying an engraved spiral about 8 ins. in greatest diameter. On the inside of this spiral are engraved numerical results, and angular results are found on the outside, in degrees and minutes. Over this card, and revolving on its center, is a disk of celluloid, carrying certain graduated lines in black and in red; and on the same center is a movable rule with a sliding graduated band upon it. By the manipulation of these three movable parts, according to rules accompanying the computer, all calculations are made.

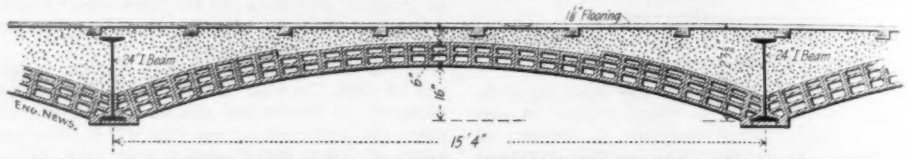
The exact operation of the computer is impossible of description without a full-sized illustration, but by the use of the book of rules, and some practice, the following are the more important of the solutions possible: General multiplication and division, with rules for the decimal point; circumference and areas of circles; powers and roots; solution of triangles; simple and compound interest; barometer elevations; reduction of stadia readings; product of any number of fractions, etc. Further information may be obtained by addressing Professor Schuerman.

TESTS OF LONG-SPAN TERRA-COTTA FLOOR ARCHES.

By Gunvald Aus.*

As very few tests have ever been made on long-span terra-cotta arches, the results of a test recently made on the floors now in place in the new Appraiser's warehouse in New York city will be of interest to the readers of Engineering News.

The floors in this building are built of 24-in. I-beams supporting terra-cotta arches of generally 11 ft. 6 ins. and 15 ft. 4 ins. spans. The spans of the I-beams are generally 23 ft. The terra-cotta arches are 6 ins. thick for spans up to 11 ft. 6 ins., and for longer spans the terra cotta is made 8 ins. thick for a length of about one-fourth of the span at each end of the arch, the central portion being 6 ins. thick.



SECTION OF FIRE-PROOF FLOOR IN NEW APPRAISER'S OFFICE, NEW YORK CITY.

The general construction will be seen from the accompanying sketch. The arches are cut by tie rods 5 ft. 9 ins. apart, in such manner that one panel of 23 ft. length practically forms four separate arches of 5 ft. 9 ins. length.

Two tests were made last spring on the arches of 15 ft. 4 ins. span, one with symmetrical loading on an arch without concrete backing, and one with one-sided loading on an arch which had the concrete backing in place and temporary flooring nailed to the nailing strips. The concrete backing was, however, quite green. This latter test was carried on until the arch fell, about 42,000 lbs. being on the arch on an area of about 7 ft. 6 ins. × 4 ft. 6 ins., or about 34 sq. ft. This gives 1,250 lbs. per sq. ft. loaded as the breaking load, but only about 1,000 lbs. per sq. ft. over the half section on which the load was placed, and only 500 lbs. per sq. ft. over the whole area of one section of arch. Heavy shores were put under the supporting beams while this test was made.

It is very likely that a one-sided load may be the worst loading for this arch while the concrete backing is still green, but owing to the great thickness of this backing at the point where the break would occur under such loading, I think full loading will cause the most severe strain after the concrete in the backing is thoroughly set.

For these reasons I did not think that the tests above referred to showed the actual strength of these arches, and it was determined to load one section of arch till it fell, or until it carried a load of 1,200 lbs. per sq. ft. over the entire area, this being considered sufficient.

The strain on extreme fibers of the supporting beam would, under this load, amount to about 24,000 lbs. per sq. in. I did not, therefore, consider it necessary to shore up the beams.

Loading began by piling brick over an area 15 ft. square, or over a length of nearly three sections of arch. This area was loaded to 400 lbs. per sq. ft. by 21 courses of brick. Care was taken not to bind the bricks, which might have made the pile act as an arch. This was done by building the pile as a series of 8-in. walls parallel to the axis of the arch.

The deflections of the arch were measured by three gages, one under the center section loaded, and one under each of the adjoining sections. These gages were made of horizontal planks pivoted to a post at their center, carrying at one end a pole resting against the bottom of the arch. The other end, which extended to a safe distance beyond the loaded arch, was counterbalanced and rested in a guide on a post carrying a scale on which the deflections could be easily read to 1-32 in.

At 100 lbs. per sq. ft. the deflection was ⅛ in., at 200 lbs. ¼ in., at 300 lbs., ⅜ in., at 400 lbs., ½ in. This load was left on for 39 hours, but caused no additional deflection.

In order not to overstrain the beams, the load was now removed from the two outer sections and piled over the center section after a layer of 1-in. boards had been laid across the 21 courses in place to tie the pile well together.

Only a slight additional deflection was caused by concentrating the whole load on this one section. At 1,000 lbs. per sq. ft. the deflection was only 9-16 in., at 1,200 lbs. ⅝ in., on the gage directly under the loaded section.

The two gages which were under the adjoining and now unloaded sections showed still a deflection of ⅜ in., which I think would indicate that the entire arch actually carried the load, although concentrated over only one section.

After the load of 1,200 lbs. had remained on the arch for 24 hours without causing any additional deflection, it was removed, when the arch gradually began to rise, recovering, when all the load was removed, its original position within about ⅛ in.

As this permanent set is very slight, I do not think that the applied load strained the arch beyond its elastic limit.

As practicaly no load could be transmitted through the trra-cotta arch beyond the tie rods, I would assume from this that the load to a great extent was carried by the concrete backing, which is in no way cut up by the tie rods.

The supporting beams showed no deflection, although the strain on extreme fibers should, under the load of 1,200 lbs. per sq. ft. over one section, amount to about 24,000 lbs.

I think this is due entirely to the concrete backing, which, in connection with the beams, forms combination girders, the concrete forming the compression, the beam the tension chord.

If this is really the case, it explains, I think, the great rigidity of many an old floor where the strain on extreme fibers of the supporting beams, figured as "beams," would be far beyond the elastic limit. My idea is that the beams act principally in tension, the brick arches and concrete backing forming the compression flange.

The writer is indebted to Mr. W. M. Aiken, Supervising Architect of the Treasury Department, for permission to make public the results of these tests in the columns of the Engineering News.

* Engineer of Steel and Iron Construction, Supervising Architect's Office Washington D. C.

The cost per ton of armor plate furnished to our battle-ships by the Bethlehem and Carnegie companies can be roughly estimated by the following facts: The original contracts made by Secretary of the Navy Whitney aggregated 13,000 tons, and 7,000 tons more were ordered afterwards. For this 20,000 tons the government has paid $13,000,000 in round figures, or an average of $650 per ton. The greater part of this armor is required for the four battleships "Massachusetts," "Indiana," "Oregon" and "Iowa," and the remainder went to the armored cruisers "New York" and "Brooklyn," with about 2,000 tons consumed in the conning towers of smaller ships. It should be said, however, that in this expenditure is practically included the cost of creating an entirely new industry in this country, entailing an investment of about $3,500,000 upon the two firms manufacturing armor plate. As the government was the only purchaser, and as further work was not insured, it is to be presumed that the government has paid for the equipment of the plant in the aggregate expended. Less the cost of plant, the price per ton of this armor would be about $475.

RANDOM NOTES BY RAIL.

(Editoral Correspondence.)

Montreal to Winnipeg.—Ottawa is one of the prettiest cities on the continent, having good streets, with plenty of shade trees, numerous handsome buildings, fine parks and the magnificent Parliament buildings of the Canadian Government. Among the special points of technical interest is the utilization of the power of the Chaudiere Falls for the innumerable sawmills and for driving the plant of the electric railway. The cars of this railway are fitted with the electric heaters made by Ahearn & Soper, of Ottawa. The track is of girder rails, with white firebrick paving along each side of the rails and asphalt paving between. The cars are run at very high speed. Beyond Ottawa the most interesting part of the C. P. Ry. is that along the north shore of Lake Superior, the alinement keeping close to the shore, necessitating some long tunnels and trestlework and heavy rock cutting. At Fort William, where the line leaves the lake shore, an extra sleeping car is put on to accommodate the passengers who have come by the C. P. Ry. steamers from Owen Sound and Sault Ste. Marie. Beyond this point the line is through a rough and rocky country, which seems to promise little for settlement, although mineral deposits may, perhaps, be developed, as just south of here is the Rainy Lake district, where good gold deposits are reported.

Besides the rockwork, there are numerous swampy tracts of land, some of which were originally crossed by trestles, but now by solid banks. Near Winnipeg the country becomes more level and prairie-like, but there is little real prairie east of Winnipeg. An absolutely level plain is the site on which Winnipeg is built. It is a large, clean city, of pleasing appearance, having many fine buildings and stores, including the large brick building of the Hudson's Bay Co. At the time of your correspondent's visit, the perennial Hudson's Bay Ry. scheme was again up for public discussion, but people in general do not appear to take it seriously, the opinion being that the main object is to keep the scheme sufficiently alive to apply for government subsidies. If coal should be found in commercial quantities, however, as is anticipated, the line might be built, but it would be for a westbound coal traffic instead of an eastbound grain traffic. Winnipeg has broad streets, and round wooden blocks are the common pavement. Some of the street extensions are marked out across the prairie, a line of telegraph poles and a raised plank sidewalk being the only present indications of the street, and in one case a road grader was opening a street, plowing up the virgin prairie and making a strip of dirt road along the middle of the future street.

West of Winnipeg the Canadian Pacific Ry. crosses flat and rolling prairie country. The most important towns are Portage la Prairie and Brandon, where lines branch to the northwest and southwest, and Regina, whence a branch extends north to the Saskatchewan River, in what is said to be a very rich district. Moose Jaw, where connection is made with the Soo line to St. Paul, is a divisional point, with roundhouse, etc. Here the sage brush begins to appear, the gray brush and clouds of dust on a hot summer day being in striking contrast with the grass and flowers of the prairie. The C. P. Ry. has a flower and vegetable garden here, in which passengers can stroll while the train stops, and there is also an hotel for the accommodation of passengers stopping over for connections between the two lines.

Fuel records are carefully kept, and some of the engines display a sign on the side of the cab, having the words, "Best Fuel Record, Passenger." The sleeping cars on the through trains are specially worthy of note, on account of the use of two sofa berths, which afford comfortable resting places during the tedium of travel, and a large smoking-room at the rear of the car, the bathroom and men's toilet-room being between the smoking-room and the saloon. The smoking-room has side seats accommodating about eight persons, and the large side and end windows make this a pleasant place from which to view the railway and its scenery. The cars were built by the Barney & Smith Car Mfg. Co., of Dayton, O.

Moose Jaw to Minneapolis.—From Moose Jaw there is a route to Montreal by way of St. Paul and Sault Ste. Marie, and through cars are run from the Pacific coast by this route. Starting from Pasqua, the next station east of Moose Jaw, the Canadian Pacific Ry.'s branch towards the United States boundary has a generally southeast direction across a prairie which is even more desolate than that along the main line, for while the latter line has been open long enough for settlements to grow up along it, the former line was built in 1893, so recently that for miles and miles there is nothing but the prairie, unbroken by a field and showing not even the roughest kind of a shanty to represent the nucleus of a future village or town.

The line was pushed through in a hurry and has the minimum amount of earthwork, averaging only 7,200 cu. yds. per mile. The track is laid directly on a shallow bank of earth scraped from the surface of the prairie, and is in some cases practically level with the prairie and only separated from it by the side ditches. The surface of the earth banks is cracked, like that of a dry mudhole, and the edges are rounded off in a bold curve, apparently by the weathering action of rain and storms. Pipe culverts are used. For the greater part of the distance there is no ballast, the ties being laid directly upon the earth bank, and the surface is rough beyond description, so that the cars roll and lurch in a most disturbing manner. The track is laid with 72-lb. rails, having three-tie joints spliced by six-bolt angle bars, and there are 15 to 16 ties to a rail length, the mud ballast being above the ties at the middle and halfway below their tops at the ends. In some places the track appears to be badly center-bound.

Across this unsettled country, which is apparently very fertile, no wells have been sunk and there are no water stations; the engine therefore hauls a water-tank car behind the tender. The train, on the occasion of your correspondent's trip, was made up of an eight-wheel engine, tender, water tank, mail car, baggage car, first-class car, sleeping car and tourist car, the latter being used as a dining-room car and cut off at Portal, the U. S. boundary. These tourist cars are intended for the use of pleasure or prospecting parties, and have ample kitchen accommodation, and the usual arrangement of sleeping berths, but the finish is less elaborate than, though probably quite as comfortable as, that of the Wagner or Pullman cars. They have a full equipment of linen, table requirements, etc., and each is in charge of a porter. These cars were built by the Crossen Car Co., of Coburg, Ont.

In the district east of this line and south of the main line the Canadian Pacific Ry. has built a number of development railways, which have materially hastened the settling-up of the country. At Portal the line crosses the boundary and connects with the western division of the Minneapolis, St. Paul & Sault Ste. Marie Ry.

This line, which was built under pressure to meet the Canadian Pacific Ry. by a certain date, is of more substantial construction and has a much easier-riding roadbed. The Chief Engineer, Mr. W. W. Rich, M. Am. Soc. C. E., believes that 10,000 cu. yds. of earthwork per mile is a minimum for a good road; to keep the grade well above the prairie and avoid trouble from snow. In a later issue we shall give a description of the tracklaying work on this line.

The trestles have ties close together and outside guard timbers faced with angle irons 3½ × 3½ ins. The track is laid with 60 and 72-lb. rails, on 16 ties to a rail length, but the ties are not barked, as they should be. North of Valley City the joints have three ties and are spliced with 40-in. angle bars and six ⅞-in. bolts. South of that point they are spliced with 23-in. four-bolt Samson fishplates and angle bars, with bolts spaced 4½, 7 and 4½ ins. These joints are suspended, the joint ties being spaced 7 ins. apart between faces. Split switches are used, having a guard rail fastened on the inside of each swith rail. Side tracks are fitted with derails operated in connection with the switch. Metal cattle guards are used. Among the track tools used on this road (as on other roads of the same character where weeds are plentiful, ballast scarce, and section gangs limited) is a long-handled, weed-cutting hoe, which is less productive of back-ache than an ordinary shovel for continuous use.

The northern part of the line is across prairies to a considerable extent, but further south the country becomes more hilly, the line following a succession of valleys. The line passes through a good country in which the company is now endeavoring to interest settlers, but while its main traffic will be agricultural products, there are also some mineral resources on the line, including a good quality of lignite in the neighborhood of Minot, N. Dak., where the line crosses the Great Northern Ry.

This lignite, in which the wood fibers are readily distinguishable, is burned successfully for domestic use in stoves of special pattern, but so far it has not been found practicable to use it on the locomotives, being so light that the draft tears up the fire and blows the particles out through the smokestack. Mr. Rich proposed the use of a double grate formed of water tubes, thus holding the fire down, but one difficulty with this would be to keep the joints watertight. As coal has now to be brought from a considerable distance, with consequent expense, and as compound engines are in use on this road, it might be found economical to experiment with the application of a Wootten firebox to a compound engine for burning this local fuel. It might also be practicable to make the material into briquettes, as is done with some of the German lignites.

Minneapolis and St. Paul.—Minneapolis is a busy and handsome city, having wide and well-paved streets and many fine buildings, while its system of transfers on a complicated network of electric railways very much facilitates rapid transit. The Mississippi River in the summer is not a very imposing stream at this early part of its course, especially as it is crossed by so many bridges, cut off by a dam and hemmed in by immense flour mills, while work is in progress on the dam for a new water-power system below the city. Your correspondent's stay here was short, but a few business inquiries appeared to show that work is plentiful and the prospects for business prosperity are bright. The Gillette-Herzog Mfg. Co. has a number of orders on hand for bridges, mill buildings and other structural work, and is making a specialty of combination bridges for Western states, where timber is plentiful and the freight makes ironwork expensive. Mr. Llewellyn, engineer for the company, has prepared designs for such bridges of different span, and a special feature of these bridges is that the wooden members can be replaced with iron members if it should afterwards be desired to have an all metal bridge.

St. Paul is a rather disappointing city compared with Minneapolis, having narrower and more irregular streets and a great deal more smoke and dirt. In the residence district, however, it is doubtful if any city can show a finer street or a finer set of handsome residences than Summit Ave., St. Paul.

The American Hoist & Derrick Co. reports that the commercial outlook is promising, and that its own business is very good, some parts of its plant working 12 hours a day. An interesting machine in course of erection is a 10-ton traveling derrick, built entirely of iron, and intended for use on the Colbert Shoals work of the Tennessee River Improvement. The mast and the 30-ft. boom are each composed of two channel irons, connected by top and bottom lacing bars. The machine runs on a track of 12-ft. gage, and has the usual arrangement of vertical boiler and hoisting engine at the back of the car frame, counterbalancing the boom. Some of the derricks built by this company for the Chicago Drainage Canal were illustrated in our issue of Sept. 26.

Comparatively little is heard now about the use of aluminum in surveying instruments, but Kuhlo & Ellerbe are using aluminum standards in their transits, and state that they give good satisfaction. They are of different pattern from the ordinary brass standards, being specially designed to ensure siffness and strength. The metal has 7% of copper added to it, and brass bushings are inserted for the transit bearings.

St. Paul to Chicago.—The Chicago, Milwaukee & St. Paul Ry. is noted specially for its excellent track, maintained under the supervision of Mr. Don J. Whittemore, M. Am. Soc. C. E., the Chief Engineer of the road, and for its general use of the block system in operating, although it has not the complete signal equipment which usually accompanies the introduction of this system. The sleeping cars, built by the Pullman Company, are owned and operated by the railway company. The night trains on the "Fast Mail Line" between Chicago and Milwaukee are noted for their use of the electric light in the cars, the current being generated by an 18-HP. Westinghouse engine and 12-K-W. dynamo in the baggage car. A lamp is let into the fixed part of the partition between the berths, so that any passenger can turn on the light and read while lying in his berth. During the winter a special car, fitted with plant for the electric lighting and steam heating of the train, is used (Eng. News, Oct. 12, 1893). At Chicago your correspondent made but a very brief stay. The north end of Jackson Park is now restored to its original condition, and only the Art Building and the German Building remain as reminders of the famous Columbian Exposition. The latter was presented to the city and forms a resting place for visitors, while the former (the only permanent structure of the exhibition) is now the Field National Museum, and contains a selection of exhibits of all kinds, including the unique collection of full-size historical locomotives (actual or modeled) and other transportation exhibits. The attendants in the building wear the uniform of the Columbian Guard of 1893. Further south are the steel skeleton arches of the Machinery Building, and a scrap heap a third of a mile long, which is all that remains of the Manufactures Building.

The Metropolitan Elevated Ry. has a substantial track and first-class equipment, but the noise and vibration of the air-pump in the corner of the motor car are sufficient to be an annoyance. The rails have six-bolt, angle-bar supported joints, with bolted clamps on the middle tie. The Lake St. Elevated R. R. has a lighter structure, and its equipment resembles the older engines and cars of the New York elevated railways. The rails have four-bolt angle-bar suspended joints, reinforced by the McConway & Torley joint, but there is considerable noise at the joints. There are 18 ties to a rail length.

Chicago to Pittsburg.—The union terminal station used by the Northern Pacific R. R. and the Baltimore & Ohio R. R. at Chicago is a handsome building, and at the end of the train shed is a large covered court for the use of cabs and stages, so that passengers have not to go outside the building or to cross any streets in order to reach these conveyances. The Baltimore & Ohio R. R. has an excellent line to Pittsburg, with long tangents and a well-maintained track, so that the trains ride remarkably smoothly at high speeds. The entrance to Pittsburg over the Pittsburg & Western R. R. gives a most discouraging and gloomy impression of the "smoky city," and leads one to wonder if it will ever be found practicable to apply smoke-consuming methods to the hundreds of steel works and other factories whose chimneys now send forth a continual stream of dense, gray-black smoke, which forms a pall over the city. If the proposed "smoke ordinance" is enforced, the results will be worthy of attention. At the time of your correspondent's visit there was considerable talk about the spread of typhoid fever in Pittsburg, due to the foulness of the water supply, but a former superintendent of the waterworks declared that the water was as good as the Croton water of New York, and that the agitation for filtration is largely the work of persons interested in filtration processes. Your correspondent's experience, however, is that Pittsburg water does not look or taste good to a palate accustomed to the water supply of New York and Brooklyn. In fact, it would seem to the casual observer that Pittsburg ought to be a very unhealthy city, judging from its air and its water. The Pittsburg Locomotive Works has a large and thoroughly modern plant, with well-arranged shops of brick and iron, containing an excellent equipment in the way of tools, cranes, etc., and having a capacity of 250 locomotives per annum. This firm has its own system of compounding locomotives, which is designed for two-cylinder engines, and the special feature of which is the intercepting valve, of which we shall publish particulars in a later issue. H. K. Porter & Co., the well-known builders of light locomotives, have recently built several compressed-air engines for mining and factory work, including two, with cylinders 9 × 14 ins., for a company at New Orleans, La., to be used in hauling cotton between the wharves, the compress plants and warehouses, where the inflammable nature of the surroundings makes the use of steam or electric locomotives dangerous. The Schoen Mfg. Co. is busy on pressed steel fittings for car work, and is manufacturing pressed steel bolsters for freight cars in the large Niles press, put in for making the steel ties for the New York Central R. R.

The bridge companies are well supplied with orders, mainly for ordinary types of railway and highway bridges, but the Pittsburg Bridge Co. has an order for a bascule bridge for the Chicago & Northern Pacific R. R. This company's shops are well arranged for handling the raw material and passing it step by step through the shops until it reaches the loading yard. At the time of our visit, a shipment of angle irons, 6 × 6 × ¾ ins., of unusual length, was being unloaded by means of an air-hoist cylinder on the end of a horizontal revolving crane boom. A specially interesting machine here is one for planing the racks and drums of turntables for drawbridges. The rack and drum are erected on the bedplate, and across this plate extends an arm carrying the cutters, this arm being adjustable vertically.

Chester B. Albree, of Allegheny, Pa., manufacturing bridge railings, reported business as good both in railings and in iron stairways and other ornamental work for office buildings, etc. Mr. Henry S. Hall, President of the Verona Tool Works, stated that the sales of the Verona nut lock have approximated 225,000,000, and called attention to the new jack and track gages which were illustrated in our issue of Sept. 12. The desirability of adopting standard designs of track tools has been officially recognized by the New England and American roadmasters' associations, and the latter has even adopted certain standard designs, which were illustrated in our issue of Sept. 20, 1894, but the adoption of these standards appears to make but slow progress, individual roadmasters apparently still preferring their own familiar tools, although they may have voted in favor of standard designs on general principles.

The Federal St. & Pleasant Valley Passenger Ry. Co. is building a long extension of its electric line into the open country beyond Allegheny. The line has heavy grades and curves, and the track is laid with girder rails, the joints of which are made solid by the Falk "cast-weld" system. As the line is single track, with turnouts, a block system has been introduced, consisting of incandescent lamps in a box carried on a telegraph pole, the lights being thrown in or out of circuit by a handle operated by the car conductor.

Pittsburg to New York.—Numerous parted freight trains were seen on the Pennsylvania R. R. between Pittsburg and New York, the principal causes appearing to be the breaking of links in the old-fashioned couplings, and the pulling out of M. C. B. drawbars, the tail fastenings of the latter seeming to be insufficient to withstand the strain to which they are subjected in service. A great deal of money has been spent in improving the alinement of the road, and at many places can be seen the curves and reverse curves of the original construction, which have been replaced by tangents or easier curves. At one place there is a single-track cut-off built for the exclusive use of express trains. The ballast is mainly of broken stones, but in places this has been covered with stone screenings filled in over the ties. A noticeable feature on the busy four-track New York Division is the complete automatic block signal system, with overlapping blocks, which has replaced the old manual block system for which the Pennsylvania R. R. was famous at a time when signals and block-working were little thought of in this country. The immense trainsheds at Philadelphia and Jersey City have been described in our columns. The whole division is an excellent example of American railway construction of the first class for heavy and fast traffic.

THE PASTEUR INSTITUTE AND THE MANUFACTURE OF ANTITOXINE.

The recent death of Louis Pasteur, founder of the Institute at Paris which bears his name, renders especially timely a letter regarding the French Institute contributed to the "Polytechnic" of Oct. 26 by Prof. Wm. P. Mason, of the Rensselaer Polytechnic Institute. Professor Mason first describes the Pasteur Institute and then its work in the study of bacteriology, and notably the bacteriology of disease. Aside from the extensive chemical and bacterial laboratories housed in an H-shaped building, there is a veritable zoological garden where rabbits, monkeys, rats, mice, guinea pigs, chickens and dogs are kept in abundance for experimental purposes. This is all in the city. The horses from which antitoxine is produced are outside the city, as described below. A hydrophobia clinic is held at 11 a. m. each day, at which from 50 to 60 patients appear for treatment. During May, June and part of July a regular course in bacteriology is given. This is free to all, including foreigners, when there is room, on presentation of a letter from their proper ambassadors.

The antitoxine is manufactured at Garch, about 18 miles from Paris, where some 80 fine horses are kept in a government park. The process is described by Professor Mason as follows:

A horse is inoculated with a small dose of the poison of diphtheria, insufficient in quantity to kill, and in bulk about a half-thimbleful. This dose is gradually increased every other day during three months. When the dose has reached 200 cu. cm., which may be repeated for three or four days in succession without hurting the horse, the animal is in condition for the manufacture of the antitoxine. During this process the horse has had at times a slight fever as a result of the inoculations, but so carefully is the dose of poison increased that there have been only two deaths out of 110 horses. In order to prepare the antitoxine, blood is taken from the jugular vein of the immunized horse and received into sterile glass jars, in which, after standing 24 hours, the blood clot separates from the serum. This serum is drawn off into sterile packing bottles, and is ready for use as antitoxine. Bleeding takes place on Mondays and Wednesdays, in the morning, the same horses being bled on the two days. Six quarts of blood are taken from each horse Monday morning and four quarts on the following Wednesday. The animals are then given 20 days' rest, when the bleeding is repeated, as above, indefinitely. One horse, at the time of my visit, had already furnished 400 quarts of blood. In order to maintain the immunity of the horse, 200 cu. cm. of the diphtheria poison are introduced into each horse on the Thursday, Friday, Saturday and Sunday following the Wednesday bleeding, in all 800 cu. cm., which is more than 1½ pints per animal.

To prepare the toxine, or diphtheria poison, with which the horses are inoculated, bouillon, or clear beef soup, is made slightly alkaline, and 2% of beef peptone is added. This liquid is sown with diphtheria germs, taken from the throat of a diphtheria patient. A gentle current of air passing over the liquid, which is kept in a conical flask, causes a luxuriant crop of diphtheria germs to grow on the surface. During the process of growth the germs produce the highly poisonous diphtheria toxine, which goes into solution in the liquid. This bouillon is then filtered through a Pasteur filter, which permits the passage of the liquid toxine, but filters out the germs. This solution of toxine may be kept for any length of time. In order to determine its strength, experiment is made upon rabbits, the weights of which are known, by which means it is determined what volume of the toxine it will take to kill one pound of animal. Knowing the weight of the horse and the poisoning power of the toxine, it is easy to calculate, and consequently to avoid, the fatal dose for the horse in question, the horse being given a dose less than that which will produce death.

The presence of this toxine in the horse's blood stimulates nature to produce an antitoxine to counteract. As the doses of toxine gradually increase, the quantities of antitoxine in the blood are increased likewise, until the time comes when the blood contains so much antitoxine that the animal is immune from further doses of the toxine. The introduction of the serum of the blood of an immunized animal into a human being supplies immediately nature's remedy for counteracting the diphtheria poison.

IMPROVEMENTS IN INTERLOCKING PLANTS, MICHIGAN CENTRAL R. R.*

By H. D. Miles.**

If it were feasible all facing switches and derails in a high-speed route should be bolt-locked by the connection that operates the signal or signals governing said route. As such an arrangement is generally not practicable, those facing points that cannot be so locked should be protected by facing-point locks. The present practice on the Michigan Central R. R. is to use facing-point locks on all main-line facing-point switches and derails, also to lock them with the home and distant signal connections where convenient. Switch and lock movements are used on main-line trailing points and side-track switches and derails only, said points being locked by the connections of signals that govern them in the facing direction.

It was found that a switch and lock movement attached to the facing-point switch was not safe, and, further, that such a movement, wire-locked with the home signal, was likewise open to danger. A series of tests established the fact that if a switch and lock movement failed to close the point, there was so much give in the wire lead to the home signal that the signal lever could be reversed without the home signal being cleared. This unlocked the distant signal lever, allowing the distant signal to be "pulled" to safety. To remedy this defect, it was decided to wire-lock the distant as well as the home signals with all facing-point switches and derails that were not protected by facing-point locks.

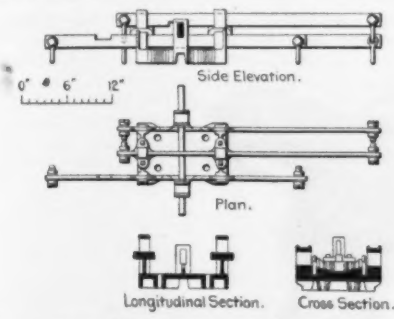


Fig 1. Three Way Wire Lock for Locking Home and Distant Signals with Facing Point Switches and Derails, Michigan Central R. R.

A new style of wire lock (Fig. 1) was designed to accomplish this, which could be used either as a two or three-way lock, a three-way lock being necessary where two blades are used on the home post. This lock is constructed so that it can be placed close to the lock-bar guide of the switch and lock movement. The switch lock-bar is made long enough to pass through both the guide casting of the switch and lock movement and the wire lock, without the intervention of a pin and jaw coupling. With this location of the wire-lock, and by blunting the lock pins of the switch and lock movement, a much closer locking can be obtained than by the usual method of using beveled point lock pins, placing the wire lock anywhere from 4 ft. to 20 ft. from the switch, and using a pin and jaw coupling between the switch movement and the wire-lock. This wire-lock used as a two-way lock has another advantage over the lock in general use. The bars to which the wires are attached are 6 ins. apart, and as no switch has over 5 ins. travel the switch can, therefore, never be left in a position where the wire-lock bar can be pulled through the wrong slot in the switch bar. To convert the lock into a three-way, two small guide castings are placed on either side of the switch bar and held in place by machine bolts. The wire-lock bar passes through these guides and a slot cut in the top of the switch bar, the slots for the other two bars being cut in the underside of the switch bar.

The principle of wire-locking the distant signal with the facing-point switches and derails where the switch and lock movement is used was considered so vital by the Railroad Commissioner for the state of Michigan that he embodied it in the rules governing interlocking construction.

The defect in the facing-point lock, as all signalmen know, is that if the switch connection breaks, the switch lever can be reversed without affecting the switch, and there is danger in such a case of locking the switch in the wrong position. Although practice has demonstrated that the danger is remote, I have personal knowledge of two failures of the above sort, and one caused an accident. Usually a switch when disconnected from its operating lever will, on account of the strain in the angle splices, open far enough to prevent its being locked, but there is a possibility of an old switch which is used frequently remaining against the stock rail.

In order to prevent a disconnected switch from being locked in the wrong direction, we have adopted, in lieu of something better, a spring-centering device, A, which is attached to the head rod of the switch, causing the switch to be thrown in the middle position, in which position the lock pin cannot enter (Fig. 2). While this device is not positive in action, it adds greatly to the safety of the ordinary facing-point lock, and is cheap to construct and easy to maintain. The Saxby & Farmer duplex detector, and the Turner facing-point lock, the latter recently placed on trial by the Pennsylvania Co., are positive in action, and if proved reliable will solve the difficulty of a weak point in mechanical interlocking.

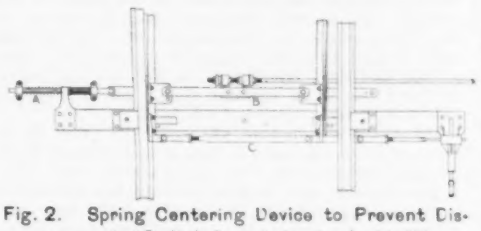


Fig. 2. Spring Centering Device to Prevent Disconnected Switch from being Locked in Wrong Direction, Michigan Central R. R.

The operating rods attached to switches have a certain amount of extra travel, which is utilized to take up lost motion that is engendered by the wearing of the pin and jaw couplings in the lead out. The switch and lock rods, B and C (Fig 2), are made adjustable in order to keep the travel of the switch a constant factor. With a switch equipped as described above, there is no necessity for enlarging the holes in the lock rods, and consequently a much closer adjustment can be accomplished, and, further, the item of expense for repairs is less than for a switch equipped with rigid connections.

The Michigan Central, having had several years' experience in the maintenance of plants, appreciates the fact that the question of economy in first cost must be largely influenced by the question of economy in maintenance and renewals. Experience has taught us that wooden signal poles must be spliced and wooden lead-out foundations renewed in from four to six years after the installation of a plant, the life of the foundations depending to a certain extent upon the conditions of the soil. As such renewals are expensive, more lasting material was sought, and the efforts in that line have led to the adoption of concrete for all lead-out foundations, and iron poles for all signals. Our first attempt in this direction was in the erection of a drawbridge plant at Michigan City during the summer of 1892. All of the lead-out foundations used in this place, excepting those used under pipe carriers, were made of concrete. On a recent inspection, these foundations were found to be perfectly rigid, and apparently as sound as the day they were put in. As it had been the practice for signal companies for some time previous to cement all crank and compensator wooden foundations for the purpose of holding them rigidly in place, it was certainly no more expensive to cement iron bolts supporting a wooden top. Encouraged by our success, all of the plants, 13 in number, erected by the Michigan Central interlocking department, from that date until the beginning of 1894, were equipped in a like manner.

Being thoroughly convinced that wood was an unsatisfactory material for foundations, we decided to abandon its use for underground work wherever possible. The forty-lever machine erected in the winter of 1894 at the crossing of the Lake Shore & Michigan Southern and Michigan Central railways, at Porter, Ind., reached a still more advanced stage in this direction. All foundations, including pipe carrier and iron signal pole foundations, were made of concrete, and all signal poles were made of iron, with the exception of two bracket poles used on the L. S. & M. S. The covering over the lead-outs was made in 8-ft. sections and fastened down with lag screws, making it easy to remove in case it was desired to paint the pipe. Despite the fact that this plant had long pipe leads, and was erected in the winter, its total cost was only $250 per lever.

As pipe rusts very rapidly in some localities, even when painted, galvanized wrought iron pipe was tried. A 10-lever machine, installed at Kensington a year ago was equipped throughout with galvanized pipe. While the test in this case has not been long enough to prove anything, we had used it previously to replace pipe that had been destroyed by brine, which had leaked from cars, and in the latter case we found it to be much more serviceable than common pipe painted. Of the criticisms that have been urged against its use, one is that the threaded portion, which is the weak point, is not galvanized pipe. As all interlocking pipes are reinforced at the coupling, and as the pipe does not rust uniformly, but depends on local conditions, and further, as it is an inexpensive matter to paint the couplings occasionally, I think that any fear on this score is groundless. Another criticism was that galvanized pipe was softer than ungalvanized pipe. To satisfy myself on this point, I had both wrought iron and steel galvanized and ungalvanized pipe tested at the Pittsburg Testing Laboratory. The compression tests show that both galvanized and ungalvanized wrought iron pipe began to compress at nearly equal loads, while the ungalvanized shows the greater strength at the failing point. The steel pipe tests show that the galvanized pipe has the advantage, both at the point of compression and at the failing point. The tensile tests show that with wrought iron pipe the ungalvanized pipe has both the greater elastic limit and the greater tensile strength. With the steel pipe, the elastic limit of each is about equal, while the tensile strength of the galvanized is the greater. The advantage in any case is so slight that there need be no hesitation about using galvanized pipe.

The concrete foundations for crank, compensator chain-wheel, and dwarf signals being heavy and unwieldy to handle, are made in the ground, in the position they are to occupy in the lead-out. Boxes of the sizes required, and open at both ends, are made of rough 1-in. timber, and placed in the ground; ⅝-in. × 30-in. bolts are suspended in the box, and the moist concrete is put in and allowed to set. Oak timber, 4 ins. thick, is placed on top of the concrete, before the latter is hard, and is held in place by the bolts that are imbedded in the concrete. The bolts project far enough above the oak timber to be utilized for bolting the vase casting.

The following are the sizes of the boxes used for the different foundations:

	Width, ins.	Length, ins.	Depth, ins.
Compensator	18	30	40
Crank	18	20	40
Wheel	14	16	36
Dwarf Signal	12	12	36
Selector	12	12	36

A concrete foundation is used at each end of the foundation timber for dwarf signals and selectors. Where there is a cluster of cranks or chain wheels, or both, a single foundation is made of a size adequate to the requirements in each case. Four bolts are used for compensator foundations, and only two for the other foundations above specified, exclusive of the special foundations. The pipe-carrier foundations are of a size convenient to handle, and are cast in molds. When hardened sufficiently, they are taken from the molds and finished, by the addition of an oak top. Fig. 3 shows the design of mold used, two sizes being made. The 11-in. foundations are made to accommodate from one to three carriers, and the 16-in. foundations from three to six carriers, depending upon the size of the

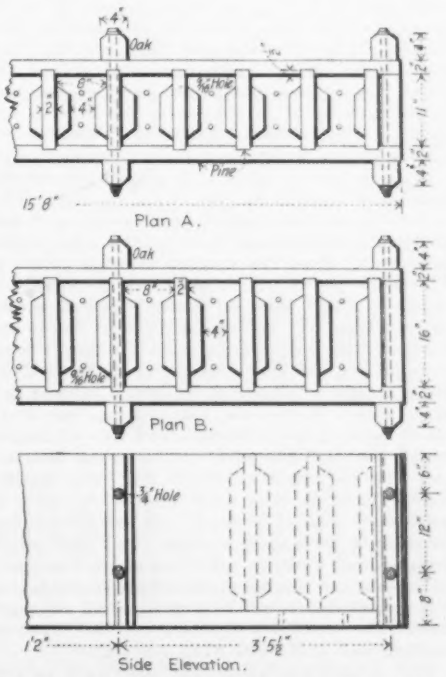


Fig. 3. Mold for Making Concrete Foundations for Pipe Carriers, Michigan Central R. R.

* Condensed from a paper read before the Railway Signaling Club at Chicago, Oct. 8.

** Signal Engineer, Michigan Central R. R.

oak top. When more than six way carriers are used, two 11-in. foundations, an 11-in. and 16-in., or two 16-in. foundations, as the case requires, are placed side by side, and a single oak top is placed over both, each foundation being of the same height and thickness. Two ⅞-in. × 14-in. bolts are used for carrier foundations. The threaded end of the bolt projects through the bottom plank of the mold far enough to be of the length necessary to hold the oak top. The concrete for all foundations is made of three parts of stone, two of sand, and one of imported Portland cement. The 11-in. foundation costs 45 cts. and the 16-in. costs 50 cts.

The first iron pole erected was at Jackson, in the summer of 1895. It is made of four 1¼-in. pipes, kept in position by cast iron braces. The braces, base casting, and bearings for the semaphore arms are held rigidly in place by babbit metal. The opening in the collars of castings, through which the pipe passes, is ¼ in. larger in diameter than the pipe, and this space is filled with babbit metal. The base casting rests on a concrete foundation, and is held in position by four 1-in. bolts. The single-arm pole cost $42, and the double arm $54.

Another design of poles consists of a single column of pipe, made in three sections, which consists of 6-in., 5-in. and 4-in. wrought iron pipe, respectively, the sections of pipe being held together by swedged joints.

Both top and bottom casting are held in place by babbit metal. The balance lever casting, being made in the form of a divided collar, is clamped to the post. A sheet iron casing, 12 ins. in diameter, is placed around the base of the pole, and the space between the casing and pole is filled with concrete. This concrete extends above the surface of the ground, and is used to prevent the base of the pole rusting. Both designs of poles in use are very neat in appearance, and should be very durable, but as the single-pipe post can be made for $10 less than the four-pipe post, it is naturally preferred.

TESTS OF THE ELECTRIC LOCOMOTIVE ON THE BALTIMORE & OHIO R. R.

Some tests made of the hauling capacity of the electric locomotive used by the Baltimore & Ohio R. R. for hauling freight trains through its Belt Tunnel at Baltimore, show interesting results. In one case a north-bound train of 27 loaded freight cars and two steam locomotives (not working) was stopped in the tunnel, where the grade is 0.8%. The rails were wet and slippery, and the weight of the train was 1,125 tons (or 1,221 tons including the electric locomotive), but the train was started easily and quickly, and was raised to a speed of 10½ miles per hour in one minute. It was hauled 150 ft. in 40 seconds and 450 ft. in one minute.

Some tests were made with a dynamometer car between the electric locomotive and the train. With a train of 22 loaded coal cars, a caboose and two steam locomotives not working, the total weight being 1,068 tons, the average drawbar pull was 25,000 lbs. on the 1% grade, and the speed attained was 11⅛ miles per hour. The pull is said to have been very uniform and steady, due to the freedom from reciprocating parts, the torque being constant for the entire revolution of the wheels. With a train consisting of 36 cars, a caboose and three steam locomotives not working (the train being made up of a through and a local freight train), the load was 1,600 tons, and the drawbar pull was calculated at 45,000 lbs. The highest record, however, was made on Oct. 6, when a northbound train of 43 loaded cars and three steam locomotives, made up by coupling two freight trains together, and weighing 1,900 tons in all, was started without any slipping of the wheels or any sparking, and quickly raised to a speed of 12 miles per hour. The drawbar pull was about 60,000 lbs. in starting and 40,000 lbs. when running.

This locomotive, which was illustrated in our issue of July 11, has now been in regular service since Aug. 4, hauling all northbound freight trains, and it is said that no delay to traffic or failure of the machinery has occurred, while none of the trains have been heavy enough to cause the wheels to slip under ordinarily fair conditions. It has been proposed to extend the run of the locomotive north to Waverly, overcoming the grade from North Ave., and also to extend it south to an engine shed at Baylies, there being at present no shed accommodation for the electric locomotive. Two more locomotives are now being built by the General Electric Co., and when they are in service the passenger as well as the freight trains will be hauled through the tunnel by electric traction.

A WATER SYSTEM FOR PLACER MINING AND A NEW TYPE OF DAM.*

By Robert Brewster Stanton, M. Am. Soc. C. E.

In the spring of 1893 the author began the construction of a pipe line and reservoirs for the development of a placer mine, comprising 14 claims on the summit of the Coast Range in southern California. The water supply was obtained about 2.5 miles from the mine, at a place where there is a basin from 1,200 to 1,500 acres in area, bounded on three sides by abrupt mountain slopes. The snow drifts and packs into this basin during the winter, and remains until late in July. Springs issue at the lower edge of the basin, at the head of San Antonio Creek, and form the source of the water supply for the mines. The water from these springs drops into the gulch at the head of this stream, and sinks into the debris that fills the gorge. To catch this water and turn it into the head of the pipe line, a small reservoir was built.

The debris was leveled off across the gulch for a width of 60 ft., leaving a bottom of finely broken granite rock, with the rock walls of the hill on three sides. A pine log dam 6 ft. high was built across the gulch, and lined with a double thickness of plank sunk into a trench in the debris, the fine rock fragments being filled back against the plank. Owing to the fact that the gravel in the mine was of limited extent, all the work done on this reservoir and other parts of the water system was of a temporary nature. There were five different materials in this small basin to be joined by a water-tight lining: shattered slate to be joined to solid granite and to the plank dam; the broken stone bottom to be joined to slate, granite and planking, and the planking to be joined to the end of the iron pipe line. This was done by covering the whole inner surface with two coats of hot asphalt paste, which was not over ½ in. thick after the crevices were filled. The paste was made of 4 parts of the best refined California asphaltum and 1 part of crude petroleum, without sand. These were boiled together until, when absolutely cold, it was brittle under the hammer, while elastic and pliable with the least warmth. This lining is in good condition after two summers and a severe winter, the only repairs made being the application of a few quarts of ashpalt last spring.

The pipe line is two miles long from the collecting reservoir to the pressure reservoir, and runs along a very steep, rough and sinuous mountain side, where it would be impracticable to maintain a ditch or flume on account of the snow and rock-slides from the mountains. The pipe was made of No. 16 sheet iron; it was boiled in asphalt and had driven joints. The first 1,800 ft. is 12 ins. diameter, then comes 2,000 ft. of 10 ins., and the remainder is 8 ins. The first 500 ft. is on a grade of 40 ft. per mile, the last 1,500 ft. has a grade of 26.4 ft. per mile, and the remainder 16 ft. per mile. Air valves are located about 1,200 ft. apart along the whole line, and cross and waste valves are provided at the upper and lower ends, and at the head of the 8-in. section. It was decided to be cheaper to lay the pipe on these continuous grades than to cross the gulches by descending into them, and the pipe line could be emptied of water in winter without the use of so many expensive valves. The size of the pipe line was not so large as recommended by the author, but was determined upon to save the extra first cost of larger sections. At three places the line is carried over gulches by wooden lattice spans, the timber for which had to be carried up the mountain on men's backs, like all the pipes, valves, asphaltum and other materials. The laying of the pipe was very difficult where an immense rock-slide had to be crossed. Here the loose top material would move without jarring, and only one 20-ft. length of pipe could be laid at a time, as a longer trench could not be kept open. It was dangerous work, for in driving the joints the heavy blows of the maul shook the whole slide.

The pressure reservoir was built for two purposes: First, as a penstock at the head of the pressure pipe leading to the mines; Second, as a reservoir to hold water for some hours during the latter part of the season, when the supply is limited. It has a capacity of 330,000 gallons, but as originally designed it was to hold 3,000,000 gallons. The depth at the bottom portion is 12.5 ft. It is located at the head of a gulch on a thickly-timbered part of a ridge above the mines. A semi-circular dam was built across the gulch of a single thickness of large pine logs, with ends sawed on radial lines and butted close together, forming an arch with a slight batter up stream. Each row of logs is separated with, and bound together by, smaller logs laid at right angles to the dam and extending up into the reservoir. As these were put in place, a bank was formed on the upper side of the timber of earth and broken rock well tamped around the logs. The slope on the upper side of this filling is 1½ to 1.

There is no material in the neighborhood that could be used in any way as puddle for a dam, and the bottom and sides of the reservoir are of earth, rotten granite and shattered slate. To make the basin water-tight, a lining was formed of asphalt concrete. This is not what is known in the street-paving business by that name, which is composed of asphaltum and sand, for clean, sharp sand would have cost $20 a ton delivered on the mountain, but is a true concrete of broken stone and asphaltum. The stone was obtained from a porphyry dike near by, and was broken into pieces 2 ins. or less in size. All the fine material was left, and enough more added to have the entire mass free from all but the smallest voids. This concrete was prepared in two street-paving pans. The rock was heated and well mixed in one pan, and the mixture of 4 parts of refined California asphaltum and 1 part of crude petroleum was boiled in the other. The boiling paste was poured with ladles over the hot rock, and the whole mixed over the fire until every particle of stone, sand and dust was thoroughly covered with the paste. The concrete was then taken in hot iron wheelbarrows to the site of the work and put in place in the usual manner, being rammed, rolled and smoothed down with hot irons. It was put on in a 4-in. layer, in strips from 4 to 6 ft. wide, and where the strips were joined, the old edge was well coated with hot paste. After the lining was finished it was painted with hot paste mixed in the same proportions, but boiled a much longer time, until, when entirely cold, it was hard and brittle, breaking under the hammer like glass, yet tough, pliable and elastic when warm. This coat was applied while the

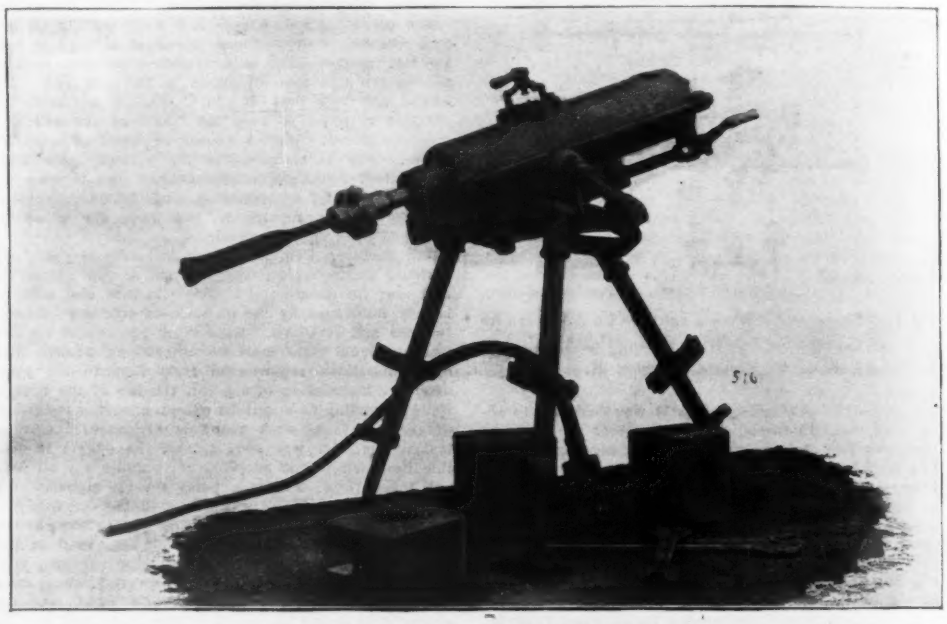


FIG. 1. THE MARVIN ELECTRIC DRILL.

*Abstract (from the Society's bulletin) of a paper to be read before the American Society of Civil Engineers on Nov. 20.

paste was very hot, and should not be over ⅛ in. thick, although, through the fault of the contractor, it exceeded this amount at some places in the reservoir mentioned. The lining cost 15 cts. per sq. ft.

In spite of the faulty manner in which the material was laid in places by the contractor, it has stood so well that the author has advised its use on a rock-fill dam, 120 ft. high, to be built in southern California. After clearing the site of the dam to bedrock, and preparing proper toe catches in the bottom of the canyon where the structure is to be located, a gravity dam is to be built of loose rock blasted from the sides and dumped in place by cableways. Care must be taken to have the larger masses of stone surrounded with smaller pieces, so as to reduce the amount of settling and movement to a minimum. The inner face of this dam is to be laid up with great care. A thickness of perhaps 10 or 15 ft. at the bottom diminishing to from 2 to 3 ft. at the extreme top should be placed by hand in the form of a well-laid dry wall. The joints should be well filled with small stones, and the surface left as even as can be done without hammer dressing, though not smooth. Starting from the bottom, every 5 or 6 ft. of this hand-placed surface should be stepped back about 3 ins., leaving a series of these narrow hermes all the way to the top. On the surface thus prepared, place a true asphalt concrete perhaps 1 ft. thick; if this is properly proportioned, mixed and laid, the 3-in. steps will prevent creeping.

THE MARVIN ELECTRIC ROCK-DRILL.*

Some four or five years ago considerable interest was created in electrical and engineering circles by the announcement that the ordinary steam or pneumatic-power rock-drill was likely to be replaced by an electric drill of extremely simple construction, based upon the principle of a plunger reciprocating inside of a solenoid coil. The apparatus was originally exploited by the Edison General Electric Co., and the first commercial electric rock-drill plant was started in a silver mine in Idaho in 1891. It was discovered, however, that the drills as then constructed had not sufficient strength to endure the severe service, and it became generally believed among mining engineers that the electric drill was a failure. Since that time, however, investigation and experiments have been carried on by the Marvin Electric Drill Co., of Syracuse, N. Y., which have proved so successful that the electric drill is now again prominently brought forward as an active competitor of steam and air drills. The company has established a plant at Canastota, N. Y., for the manufacture of these drills and the special dynamos for supplying the peculiar current required in their operation.

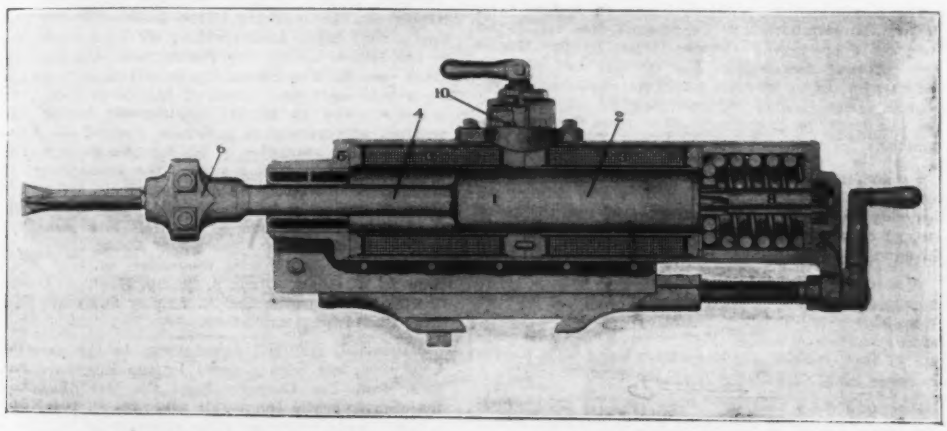


FIG. 2. LONGITUDINAL SECTION OF MARVIN ELECTRIC DRILL.

Fig. 1 is an external, and Fig. 2 a sectional, view of the Marvin electric drill as at present constructed. The drill proper consists of a solid steel plunger, surrounded by two coils of wire, through which electric currents are caused to pass. Referring to Fig. 2, 1 is the plunger or piston of the machine, and is seen to be very similar to that of an air-drill. This plunger is a solid steel forging, having an enlarged portion, 2, which is surrounded by the coils of wire, 3 3, and a shank, 4, which passes through a bearing in the front head of the machine, 5, and provided with a massive chuck, 6, for holding the drill steel or bit. The magnetic pull of the coils, 3, draws the plunger, 1, backward and forward as the current alternately passes through the one or the other. The rifled ratchet rod, 8, is provided with a ratchet wheel in the back head, 9, and enters a rifled nut in the back part of the plunger. The cushion spring, 7, is a very heavy coil spring, resembling a car spring. The function of this spring is to assist in checking the backward stroke of the plunger. It thus absorbs the surplus energy of the return stroke, and supplies the energy thus stored to the forward stroke. All of these parts are encased in a piece of boiler tube, and the front and back heads are drawn together by side bolts. A flexible cable, consisting of three wires, leads the current to the drill, and connection to the wires of the coils is made by means of brass plugs extending through the case and shown at 10.

The improvements that have been made in the construction of the drill since the original machine was put on the market four years ago are described as follows in a statement furnished to us by the Marvin Electric Drill Co:

The principal sources of trouble in the earlier forms of drills were as follows:

1. The overheating of the machines, occasioned by the effort to get a large amount of work out of a light-weight machine. This defect has been overcome in the present machines by improvements in the design of the electrical part of the machine.

2. It was at first considered necessary to use a plunger in which the extension from the magnet portion to the chuck was formed of brass or some non-magnetic material. This soft metal was found incapable of resisting the shock upon the drill rod in drilling hard rock. This construction has been abandoned, and the plungers are now made of solid steel, with a shank of a reduced diameter. They are no more subject to breakage than the steel plungers of air-drills.

3. The breakage of the cushion spring which assists in checking the backward stroke of the plunger and imparting the energy thus stored to the forward stroke. It has been found that by changing the shape of these springs and increasing their size, this defect has been entirely removed, and many of these springs have now been in use for upwards of three years, and none of them have ever yet been broken.

Another apparently minor detail, which occasioned a great deal of annoyance, was the cable connection, by means of which the wires of the flexible cable were attached to the drill. Many different forms of switches were devised for this purpose, all of them following the "quick-break" plan. It was finally discovered, however, that for the peculiar current employed in this system, a form of switch was required radically different from that employed in other electric circuits—namely, a very slow break-switch, and in the present construction the three cable wires terminate in three contact plates, which are located at the extremities of a triangle. These plates are forced down upon three similarly arranged plugs on the drill, by a screw, whose line of thrust is in the center of the triangle, thus insuring perfectly solid contact upon each of the three plugs.

The advantages of a "slow-break" switch in this system are apparent, on a consideration of the character of the current employed. If a "quick-break" switch is used, the circuit is liable to be interrupted when the current is at the top of a wave, and the interruption of a circuit at this period is attended by destructive flashing and straining of the insulation on the drill and dynamo. If, however, the current of the circuit is interrupted gradually, as by the withdrawal of a screw, the time occupied in breaking the connection between the two contact plates is so great that the wave of current is completed, and the current shut off from that branch of the circuit at the dynamo, before the contact surfaces are separated sufficiently to produce an arc of any magnitude. It will be remembered that in this system each circuit is energized only half of the time, a period of idleness following a period of activity.

When the electric drill was originally put out, every expedient was resorted to to obtain the slow-period pulsating current required for their operation, and the required currents were usually secured by slowing down the speed of a standard power generator to the required number of revolutions per minute, about 350, or by revolving a pair of carbon brushes slowly around the ordinary commutator of a continuous current dynamo. The first of these methods resulted in seriously reducing the output of the dynamo, while the second involved a more or less complicated mechanical arrangement of the dynamo, which was not well adapted for mining purposes. A dynamo has now been designed by the Marvin Co. with a view to supplying directly the slow-period pulsations required. This machine runs at the slow speed required by the drills, making from 350 to 400 revolutions per minute, as is required. The field and armature are both made up from sheet iron punchings, the armature disk being punched from the center of an oblong sheet of iron, the punching forming one element of the armature, while the remainder of the sheet forms one element of the field. Th armature winding is carried through holes near the periphery of the armature, and the wires do not cross at the ends, being carried across the ends in parallel lines, the winding being a modified form of the old Siemens shuttle winding.

This construction permits of several different sizes of machines being made from one set of punchings, the size of the machine being varied only by using more or less punchings and making the machine longer or shorter, machines of all sizes running at the same speed. The collector ring is located between the armature and bearing, while the split ring commutator, which directs the current in alternation over the circuit, is located outside of the bearing on the end of the shaft. This commutator is held in place and connected to one terminal of the armature winding by a single bolt, and can be removed or replaced in the space of a few seconds. The other end of the armature winding is connected to the collector ring inside of the bearing. The winding of the armature is so simple that an ordinary mechanic can rewind it in the space of a few hours.

The details of this machine have been worked out with a view to producing an extremely simple and rugged machine, adapted to the arduous requirements of mining plants. For mining work the machine can be readily subdivided into small parts, where it is required to transport the machinery on mule-back.

At the quarries of the Solvay Process Co., of Syracuse, N. Y., Marvin electric drills of the modern type have been in operation for over two years, with the greatest success, but the manufacturers have refrained from again entering the market with these drills, until their entire reliability had been demonstrated by several years of experience. The Solvay quarries extend over an area of upwards of a mile in length, by half a mile in width. The power plant is located in a ravine about 125 ft. below the lower level of the quarry. From this power building four lines, or feeders, extend to the different parts of the quarry, all joining on to a back line, which runs the entire length of the workings. Bare copper wire is used in line construction. From the back line wires are led over portable poles to the different parts of the quarry where it is desired to drill, and connection is made to the drill by means of 100 ft. of flexible cables. Seven drills are now in use at this quarry, and more are being made for it. Four of the drills are of the large, or 7-in., type, and are used in drilling holes 2½ ins. in diameter, and from 6 to 8 ft. in depth. Three small 5-in. drills are used for block holing and plug and feather work. A careful record is kept by the Solvay Co. of the daily performance of each of the drills, so that it is possible to determine exactly what work they have done.

This plant was started with three drills in January, 1893. The average performance on each drill during the entire period since that time has been over 68 ft. per day of 10 hours, including all time lost in moving and shifting the machine. A single machine, in the space of two years, cut over six miles of 2½-in. holes. The rock is hard blue and gray limestone, and the broken and seamy nature of the formation makes the drilling more difficult than would be the case in a more solid rock.

Repairs upon the drills have been comparatively small, and none of the defects which characterized the early type of drills have thus far developed.

* For previous articles on this subject see Engineering News of May 16, 1891; Aug. 25, 1892, and May 25, 1893.

Pittsburg's smoke-prevention ordinance is now in force, and nine smoke inspectors are at work, under the direction of Mr. E. M. Bigelow, Director of the Department of Public Works, cautioning the offenders against the law and making reports to the Director, which may be made the basis of future legal proceedings. From the reports of the inspectors it appears that there are 638 smoke-producing establishments in the city, operating 1,706 boilers, rated at 148,396 horsepower. Of the 638 concerns, 180 are reported as using smoke-preventing devices; 145 as using gas, coke or hard coal, 60 as having contracted for smoke consumers, 7 as using devices on part of their boilers, 13 as having boilers not in use, 11 as thinking that smoke-preventing devices are not necessary, and 222 as having made no preparation.

The new East River Bridge Commission received, on Oct. 30, a delegation of the managers of Brooklyn surface and elevated roads, with a view to estimating probable traffic and the track facilities required on the new bridge. The Brooklyn Heights railway, with five lines treminating at the proposed bridge, carried 16,000,000 passengers in 1894, and two other lines running near the bridge carried 8,000,000 more. This amounts to over 60,000 per day, and about one-half the total is carried in five hours. The Queens County & Suburban R. R. line reported 50,000 passengers a day, with 35,000 getting on or off at the ferries. Both companies thought 99% of their passengers crossing the river would prefer to pass over without change of cars. Mr. Uhlmann, of the Brooklyn Union Elevated railway, thought the estimates of the surface railways were overdrawn. He quoted figures to show that the Broadway and Grand St. ferries only carried 60,000 passengers per day in all. He thought two tracks for elevated and two for surface roads would be sufficient for the traffic.

At the same session Commissioner F. B. Thurber stated that the old East River Bridge Co. offered to the present commission everything it had at cost, as shown by vouchers, but the proposition was declined.

The Brooklyn terminal of the Brooklyn Bridge is the subject of a presentment made by the October grand jury of Kings County. The jury expresses the opinion that the terminal, if completed according to the present designs, will afford entirely inadequate facilities, and recommends that the whole matter be laid before a board of engineers experienced in the management of traffic, so that, if possible, the plans may be so modified that when carried out the terminal will accommodate the public in the best possible manner. The question was discussed in our issues of Oct. 17 and 24.

The Naval Bureau of Ordnance asks for an appropriation of $6,457,984 for the year ending June 30, 1897. Included in this amount are $25,000 for arming the naval militia, $500,000 for arming auxiliary cruisers, and $4,390,204 for the armament of vessels authorized. Chief of Bureau Capt. W. T. Sampson, approves of the 13-in. caliber gun for the new battleships; sees no particular advantage in the wire-wound gun, and pronounces the Hurst gun, for high explosives, a failure. A satisfactory powder for the 13-in. gun is not yet available, though the California Powder Co. is now manufacturing an excellent powder for the 8-in. and 5-in. guns. The Bureau does not approve of contracting with the ship-builders for armor as well as for hulls and machinery.

United States naval constructors will be no longer admitted to the Royal School of Naval Architecture, at Greenwich, England. No reason is assigned for this action of the British naval authorities. For the last 12 years the United States has sent graduates of the Naval Academy to the Greenwich school for training as Assistant Naval Constructors, and nearly every year American students have taken either first or second prizes, and sometimes both, in competition with the English students. England may think that there is no longer any occasion for us to send our young men abroad for training in naval architecture.

Cleveland, O., wants an appropriation of $1,100,000 for a better harbor at that point, including wider approach and an extension of the breakwaters.

A new type of armor for warships has been devised by Mr. P. R. de F. d'Hurny, a French civil engineer, of Chicago. His idea is to secure in a steel box thin plates of steel with the edge presented to the fire of an enemy; and the advantages claimed were cheapness, ease and quickness of manufacture, and the ability to replace a damaged box at sea. He also claimed greater resistance than solid armor. A trial, at Indian Head, on Oct. 15, failed to make good the claim for resistance. One shot from a 6-in. rifle, with a velocity of 2,100 ft. per second, broke up a target of nickel steel, Harveyized plates, so made, and 6 ins. thick. But the projectile also broke up before getting through, and failed to penetrate the oak backing.

The New York Pilot Commissioners have practically decided to substitute steam for sails in the pilot service, and to reduce the 21 sailing craft to seven steamers, equipped as station boats. The gain will lie in the shortening of the cruise. The pilot is only paid for his services from Fire Island, 35 miles from Sandy Hook, to port, and it seems absurd to cruise 900 miles to the east, as is sometimes done, to obtain the same return. The present plan will fix Fire Island as the eastern limit for pilot-boat cruising, and Barnegat as the southern limit.

The fastest time on record between New Orleans, La., and San Francisco, Cal., was made last week, when the "Sunset Limited" of the Southern Pacific Ry., made the run of 2,489 miles in 3 days 2 hours 45 min., while the distance to Los Angeles, 2,007 miles, was covered in 2 days 9 hours 45 min. The average speed for the entire trip (which includes numerous stops and necessarily slow speed on the mountain divisions) was 33.3 and 34.75 miles per hour to San Francisco and Los Angeles, respectively.

The contract for a passenger terminal station and ferry-house at St. George, Staten Island, for the Staten Island Rapid Transit R. R. and the Baltimore & Ohio R. R., is said to have been awarded to Colin McLean, of New York. About $137,000 have been spent on the bulkheads and substructure of the terminal, and the building will be an iron structure, two stories high, with train shed and offices, and costing $150,000. The same contractor has also the contract for a terminal station and ferry-house for the Staten Island Rapid Transit R. R. at Tottenville.

Two robber-proof mail cars are said to be under construction for the New York, New Haven & Hartford R. R. They have vestibuled ends, and the steps are made inaccessible when the car is running.

A new railway in Nicaragua is projected, and it is reported that it will be built under the supervision of an American engineer, with funds supplied by the government. The line will run from Corinto to Rama, on the Bluefields River, about 60 miles above the Atlantic port of Bluefields. Steamers can go up the river as far as Rama.

The location of air-brake cylinders on freight cars, hopper and drop bottom coal cars, stock cars, etc., is the subject of an inquiry circular issued by the Master Car Builders' Association. The circular also asks for information as to whether the water dropping on apparatus after passing through the coal on coal cars has any damaging or corrosive effect upon the brake apparatus.

Fusees for the use of rear flagmen at night have been adopted by the Boston & Albany R. R. A pointed rod carrying the fusee is stuck into a tie and the fusee lighted by a friction cap, burning with a red light for 15 minutes. It cannot be extinguished by rain or wind.

A scarcity of freight car equipment is said to have been developed by the exceptionally large grain business this year, and the railways are looking closely after the movements of their cars, while it is estimated that probably 10,000 cars are being built for the railways entering Chicago from the East.

How to make a bankrupt railway pay for grade-crossing improvements is a problem which has been solved at Buffalo, N. Y. In carrying out the work described in our issue of Oct. 24, three railway companies which are either in the hands of receivers, or financially unable to pay their share of the improvement, have been assessed as follows:

New York, Lake Erie & Western	$917,594
Western New York & Pennsylvania	423,253
New York, Chicago & St. Louis	123,960
	$1,464,807

Under the provisions of the Grade Crossing Act, the city of Buffalo will do work and charge it to the railways. Bonds are to be issued by the city, and the railways are to pay principal and interest, in 20 annual installments, a sinking fund being established for this purpose. In this way a lien is created that will hold through all ramifications of ownership possible with a railway in liquidation.

A new arc lighting plant has been put into service by the city of Chicago. It is to supply a territory previously lighted by one of the several central stations scattered about the downtown district. There are at present 500 lights in this territory, but ample provision for increase has been made, the capacity of the new plant at the start being 1,000 lights, and space being provided for an equipment to give double this capacity, or a total of 2,000 lights. This is a greater number than the entire municipal installment at the present time.

A telegraph cable up the Amazon River, from Para to Manaos, is to be laid by the Amazon Telegraph Co. under exclusive concessions from Brazil. The length of the cable will be 1,365 nautical miles, and 16 stations will probably be established on the line. Manaos is the center of an important rubber, coffee and sugar trade, and past efforts to maintain aerial telegraph lines have failed, owing to the rapidity and density of the tropical growth. The cable steamer "Faraday" is engaged to do the work, and this 5,000-ton vessel will proceed all the way to Manaos, 1,100 miles from the mouth of the Amazon.

The Hurricane Isle Mining Co., of Maine, a granite quarrying company, is preparing a blast of about 8 tons of gunpowder. The main tunnel, 3 × 4½ ft., extends 56 ft. back of the face of the cliff, and two branches go off 30 and 35 ft. each way from the end. At the ends of this T, chambers are being worked out for the storing of about 650 kegs of powder of 25 lbs. each. The owners of the quarry hope to remove about 100,000 tons of Maine granite by the explosion of this powder.

A fuel gas to take the place of natural gas is to be introduced at Pittsburg, Pa., by the Philadelphia Co., well known as a great distributor of natural gas. A great gas-making plant is to be built on Brunot's Island in the Ohio River, a few miles below Pittsburg. The company proposes to build a railway from the island to the mainland, connecting with several railway lines which will furnish it with supplies.

The Interstate Commerce Commission has brought actions against several of the prominent Western railways for violating the law in ignoring the long and short-haul clause on traffic to Colorado and the Missouri River points. According to a published statement by Mr. A. F. Walker, Managing Receiver of the Atchison, Topeka & Santa Fe R. R., the rate-cutting was so open and so flagrant as to compel the roads which meant to be honest to join in it, and when some of the roads met the secret cuts with open tariffs, they could not make equally low rates to local intermediate points without seriously endangering the revenues of the roads and inflicting losses upon them which they could not publicly stand. He will plead on behalf of his company undue competition as its justification for ignoring the long and short-haul clause.

The Pennsylvania Heat, Light & Power Co., of Philadelphia, is said to have completed arrangements for buying out the interests of the Edison Electric Light Co. of that city. At any event, the legal proceedings of the Edison against the Pennsylvania Co. have suddenly ceased. The Edison Co. is said to be paying 8% on a paid up capital stock of $2,000,000, and it furnishes current to 102,000 incandescent lamps. The reported arrangement is a 99-year lease of the Edison plant, with a guarantee of 8% for two years and 9% thereafter on the Edison stock. The Pennsylvania Co. proposes to do business on a colossal scale, and vaguely hints at "valuable foreign patents," and the development of power and light on "entirely new plans," but enters into no details. The list of stockholders of the Pennsylvania Co. includes the names of Wm. L. Elkins, W. W. Gibbs, Edwin S. Cramp, Hamilton Disston, Charles T. Yerkes, Samuel R. Shipley and other prominent Philadelphia capitalists.

Carbonized, reforged armor-plate, to the extent of 1,100 tons, has been ordered by the Russian government from the Carnegie Steel Co., according to a despatch from the company's agent at St. Petersburg. A plate made upon the same principle as the one so successfully tested at Indian Head recently was sent to Russia, and has been tested with equally good results. This first order will keep the Carnegie armor-plate plant at work for about five months, and it comes just as the contracts with the United States are completed.

Only asphalt pavements will be laid in Berlin, Germany, during the fiscal year 1896-97, acording to a decision of the Board of Aldermen in that city, reported in the "Berliner Lokal Anzeiger" of Sept. 18. An exception is made in the case of streets where conditions of grade or extraordinary heavy traffic make stone pavements necessary. The resolution is the result of a large number of petitions from citizens favoring asphalt pavement, and it is further stated that in the future bids for such pavements will be received from any contractor, and not, as in the past, from a selected list of contractors.

The paving of Second Ave. at Long Branch, N. J., by the Atlantic Coast Ry. Co., is now in dispute between the city and the company. The latter agreed to lay brick paving as an inducement for property owners to give the necessary consent to the construction of the line, but it now finds that the cost will be very considerable, and wishes to compromise by making a money payment.

The North Carolina Railroad Commission has issued an order requiring all railways in that state to equip all their regular passenger trains, after Nov. 15, with a duplicate bell-cord, or "safety cord," to be used only when the immediate stopping of the train is desired, as in the case of accidents, etc. The roads have expressed a willingness to comply with the order.

CONTENTS OF SUPPLEMENT.

PERSONALS 149
ENGINEERING SOCIETIES 149
Coming Technical Meetings 149
NEW PUBLICATIONS 149
Trade Publications 150
CONSTRUCTION NEWS:
List of Contracts Pending 150
Railways 151
Street and Electric Railways 151
Electric Light and Power 152
Bridges 152
Buildings 153
Water-Works 153
Irrigation 154
Sewerage 154
Garbage Disposal 154
Streets and Roads 154
Manufacturing Plants 154
Miscellaneous Contracts and Supplies 155
Contract Prices 155
Metal Market Prices 155
INDUSTRIAL NOTES 155

PERSONALS.

Mr. John Mosser, a contractor and builder of Pittsburg, Pa., died on Nov. 3.

Mr. Dennis W. Sullivan has been elected President of the Coney Island & Brooklyn R. R.

to the Corps of Engineers in 1872. He was made First Lieutenant in 1874, and Captain in 1883.

Dr. S. P. Wise, of Canton, has succeeded Dr. Byron Stanton as President of the Ohio State Board of Health.

Mr. Byron R. Salyerds, a member of the New York State engineering corps, died on Oct. 24 at Scottsville, N. Y.

Mr. Rudolf Wieser has returned to Managua, Nicaragua, where he will act as General Agent of the Maritime Canal Co.

Mr. Chas. W. Grimes has been elected Assistant Engineer of the water-works system of Martinsburgh, W. Va. He succeeds Mr. Chas. Hooge, resigned.

Capt. Carl E. Palfrey,, of the Corps of Engineers, U. S. A., has resigned. Captain Palfrey graduated from the U. S. Military Academy in 1870, and was appointed

Mr. Coleman Sellers, Consulting Engineer, and Mr. Horace W. Sellers, Architect and Engineer, of Philadelphia, have removed to Room 537, Philadelphia Bourse.

Mr. D. H. Finn has been appointed Superintendent of the water-works system at Waycross, Ga., where, it is reported, extensive improvements are being made, including a new reservoir.

Mr. Wm. F. Collins, the inventor of the Lappin brake-shoe, died suddenly on Nov. 3 at Bloomfield, N. J. Mr. Collins had been Superintendent of the Lappin Brake Shoe Co., and of the Corning Brake Shoe Co.

Mr. J. W. Dalbey, formerly Superintendent of the Kansas City Northwestern Ry., has been appointed Superintendent of the Union Pacific, Denver & Gulf road on the Denver & Pueblo Division, succeeding Mr. M. F. Egan.

Mr. William Canam, Superintendent of the steel mill of the Bethlehem Iron Co., died on Nov. 2, at the age of 67. Mr. Canam rolled the first rail made by the works, and was associated for 30 years with John Fritz, the builder of the plant.

Mr. G. F. Curtiss, of whose death we have just received notice, was a graduate of the Massachusetts Institute of Technology and an engineer of considerable ability. At the time of his death he was in the employ of the General Electric Co.

Mr. J. M. Barr, formerly General Superintendent of the Western Division of the Great Northern Ry., has been appointed General Superintendent of the Eastern Division, to succeed Mr. E. W. McKenna, whose resignation was noted in our issue of Oct. 24.

Mr. W. H. Linn, City Engineer of Springfield, O., died suddenly on Oct. 24. Mr. Linn was born in 1853, and was educated as a civil engineer. He was identified with the construction of numerous railways, among which may be mentioned the Denver & Rio Grande and the Mexican Central. Since 1890, Mr. Linn was located at Springfield, and held the office of City Engineer throughout the five years.

Mr. James M. Wilcox, for many years manufacturer of United States banknote paper at Glen Mills, Pa., died at Haverford, Pa., on Oct. 23. Mr. Wilcox invented and made the "localized fiber" paper long used for government bonds and notes, and he also invented the "chameleon" paper used in printing revenue stamps by the U. S. Treasury Department. Mr. Wilcox, since 1880, was interested in the manufacture of American Portland cement, and he was, at the time of his death, President of the American Cement Co., and a director of the Lehigh Coal & Navigation Co.

ENGINEERING SOCIETIES.

CONNECTICUT CIVIL ENGINEERS' AND SURVEYORS' ASSOCIATION.—The autumn meeting, held on Oct. 24, at Middletown, Conn., was devoted to a visit to the Portland stone quarries and to the new bridge under construction near them, the trip being made under the guidance of President Jarvis, of the Berlin Iron Bridge Co.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.—The committee appointed by the society to formulate standard tests and specifications for sewer pipe and paving brick has issued a circular list of questions, which is now being sent to all interested persons of whom the committee have any knowledge. In view of the importance of the subject, the committee would be glad to receive replies to this list of questions from any one having knowledge of the subject, and will send the questions to any one on request. Mr. A. D. Thompson, City Engineer, Peoria, Ill., is chairman of the committee.

COMING TECHNICAL MEETINGS.

CENTRAL RAILWAY CLUB.
Nov. 8. Secy., H. D. Vought, "Courier" Office, Buffalo, N.Y.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Nov. 9. Secy., Forrest J. Smith, Denver Block, Helena.
INDIANAPOLIS ENGINEERING CLUB.
Nov. 9. Secy., C. C. Brown.
ENGINEERS' CLUB OF KANSAS CITY.
Nov. 11. Secy., F. W. Tuttle, Baird Building.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Nov. 12. Secy., F. A. Coburn, Case Library Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
Nov. 12. Secy., H. Breen, 36 Jacobson Block.
NORTHWEST RAILWAY CLUB.
Nov. 12. Secy., G. A. Seley, 80 Metropolitan Block, St. Paul, Minn.
NORTHWESTERN SOCIETY OF ENGINEERS.
Nov. 12. D. W. McMorris, Burke Bldg., Seattle, Wash.
WISCONSIN POLYTECHNIC SOCIETY.
Nov. 12. Secy., W.K. Means, Loan & Trust Bldg., Milwaukee.
NEW ENGLAND RAILROAD CLUB.
Nov. 13. Secy., F. M. Curtis, P.O.Box 1576, Boston, Mass.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 14. Secy., Jas. K. Zollinger, Norton Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
Nov. 14. Secy., H. D. Ruhm, Nashville, Tenn.
ENGINEERS' CLUB OF PHILADELPHIA.
Nov. 16. Secy., L. F. Rondinella, 1122 Girard St.
ENGINEERS' CLUB OF MINNEAPOLIS.
Nov. 18. Secy., E. Nexson, Kasota Block.
WESTERN RAILWAY CLUB.
Nov. 19. Secy., W. D. Crosman, Rookery Bldg., Chicago.
COLUMBIAN ENGINEERING SOCIETY.
Nov. 19. Secy., W. F. Hart, University Bldg., 15th and H Sts. N. W., Washington, D. C.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Nov. 20. Secy., F. Van Vleck, Los Angeles, Cal.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Nov. 20. Secy., J. A. Pilcher, Roanoke, Va.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Nov. 20. Secy., S. E. Tinkham, City Hall.
AMERICAN SOCIETY OF ELECTRICAL ENGINEERS.
Nov. 20. Secy., R. W. Pope, 26 Cortlandt St., New York
ENGINEERS' CLUB OF ST. LOUIS.
Nov. 20. Secy., W. H. Bryan Turner Block.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Nov. 20. Secy., C. W. Hunt, 127 E. 23d. St., New York.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Nov. 21. Secy., C. H. McLeod, Montreal.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Nov. 21. Secy., F. A. Charpiot, Macon, Ga.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Nov. 21. Secy., D. Carhart, Carnegie Library, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
Nov. 21. Secy., J. F. Wilson, Odd Fellows' Temple.
NEW YORK RAILROAD CLUB.
Nov. 21. Secy., John A. Hill, 256 Broadway, N. Y.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Dec. 2. Secy., F. R. Hutton, 12 W. 31st St., New York.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Dec. 2. Secy., G. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
Dec. 2. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N. Y.
WESTERN SOCIETY OF ENGINEERS.
Dec. 4. Secy., Chas. J. Roney, Monadnock Block, Chicago.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Dec. 6. Secy., O. H. Von Geldern, 819 Market St., San Francisco.
ENGINEERING CLUB OF COLUMBUS, O.
Dec. 7. Secy., David Buell.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 13. Secy., D. W. Meeker, St. Paul, Minn.

NEW PUBLICATIONS.

THE STONE INDUSTRY IN 1894. By William C. Day. Extract from the 16th Annual Report of the Director of the U. S. Geological Survey, 1894-5. Part IV., Mineral Resources of the United States. Calendar Year 1894. Pamphlet; 8 × 11½ ins.; pp. 83.

Mr. Day was the special agent of the U. S. census in charge of the collection of statistics of the stone industry for the census year 1889. Previous to that date but little attempt had been made to collect statistics of the industry. The good work done at that time has resulted in placing practically all of the quarrymen of the country on the list of the collector of statistics, and the statistics have been obtained by direct individual correspondence with the quarrymen. The following table shows the value of the various kinds of stone quarried in the United States in the years 1893 and 1894:

Kinds.	1893.	1894.
Granite	$8,808,934	$10,029,156
Marble	2,411,092	3,199,585
Slate	2,523,173	2,790,324
Sandstone	5,195,151	3,945,847
Limestone	13,947,223	16,512,904
Bluestone (estimated)	1,000,000	900,000
Total	$33,885,573	$37,377,816

The following was the product in 1894 of those states that produced over $2,000,000 worth each:

Pennsylvania	$5,245,507
Ohio	3,510,511
Vermont	3,461,332
New York	2,516,588
Illinois	2,506,684
Maine	2,507,963
Massachusetts	2,341,043

Then follow in order Georgia, Rhode Island, Maryland, Indiana and Connecticut, with products from $1,300,000 to $1,000,000. The remainder of the states produced less than $1,000,000 worth each.

The sandstone product has shown a remarkable decrease in value during the past four years, as follows: 1890, $14,464,095; 1891, $8,700,000; 1892, $8,265,506; 1893, $5,195,151; 1894, $3,945,847. This is attributed by the report to the restriction of building operations during the hard times, sandstone being used more exclusively for building purposes than any other stone. We would suggest, however, that a large portion of this decrease may be due to a change in fashion, sandstone now being largely replaced by granite and limestone. In recent years, in New York city at least, sandstone has been falling into disrepute, on account of its lack of durability. The value of the granite produce declined from $14,464,095 in 1890 to $10,029,156 in 1894, and the limestone product from $19,095,179 to $16,512,904. The report contains much interesting information concerning the qualities and the quarrying of stone, in addition to the statistics.

THE PRODUCTION OF IRON ORES IN VARIOUS PARTS OF THE WORLD. By John Birkinbine. Extract from the 16th Annual Report of the Director of the U. S. Geological Survey. Part II., Mineral Resources of the United States. Calendar Year 1894. Pamphlet; 8 × 11½ ins.; pp. 204.

This monograph is undoubtedly the best statistical treatise on the production of iron ores that has ever been written. A vast amount of labor has been performed in its preparation, including correspondence with leading authorities in all parts of the world. It contains statistics of production in the United States for the year 1894, and in the rest of the world for 1893, with figures of earlier years for comparison. Numerous maps are given showing the distribution of iron ore in various countries, and diagrams showing the growth of the iron ore industry. The following table shows the production of the year 1892, the year of maximum production;

Iron Ore Production of the World.

United States	16,300,000 tons.
Germany and Luxemburg	11,400,000 "
Great Britain	11,350,000 "
Spain	5,350,000 "
France	3,650,000 "
Austria-Hungary	2,000,000 "
Russian Empire	1,500,000 "
Chinese Empire	1,500,000 "
Sweden	1,200,000 "
Other countries	2,800,000 "
Total	57,000,000 tons.

The figures for the United States, Great Britain and Russia are in tons of 2,240 lbs., and those of the other countries in metric tons of 2,204.6 lbs. The following table shows the production of the United States in recent years.

Production of Iron Ore in the United States.

Year.	Long tons.	Valuation.	Aver. value per ton.	Tons produced in Lake Super. district.
1880	7,120,362	.....	....	1,677,814
1889	14,518,041	$33,351,978	$2.30	7,519,614
1890	16,036,043	.....	....	8,944,031
1891	14,591,178	.....	....	7,621,465
1892	16,296,666	33,204,896	2.04	9,564,388
1893	11,587,629	19,265,973	1.66	6,594,618
1894	11,879,679	13,577,325	1.14	7,692,548

THE PRODUCTION OF TIN IN VARIOUS PARTS OF THE WORLD. By Chas M. Rolker. Extract from the 16th Annual Report of the Director of the U. S. Geological Survey, 1894-5. Part III., Mineral Resources of the United States, Calendar Year 1894. Pamphlet; 8 × 11½ ins.; pp. 88; Pub. Doc.

According to this report, the world's production of tin has risen from 50,290 metric tons in 1884 to 83,387 tons in 1894. More than half of the product comes from the Straits Settlements in the Malay peninsula. The following is the summary of production in 1894:

	Long tons.
The Straits to Europe and America	46,724
England	*8,800
Australia to Europe and America	5,824
Banca sales to Holland	6,139
Billiton sales to Holland and Java	*4,764
Bolivian imports into England	3,482
Straits to India and China	4,655
Sundry countries	642
Total, long tons	81,030
Total in metric tons	82,326
Germany, metric tons	896
Austria, " "	*65

* Estimated.

The report contains, in addition to statistical tables, an account of production and prices, and a geographical review of the tin mines of the world. The production of tin is increasing, and there are evidences that we are approaching the maximum production of the Straits and Penang shipments, but it is not likely that

the world's production of tin will decrease for some years to come. The United States, though such a large consumer of tin, does not at present figure as a producer of the metal. The report states that "no tin is being produced in the United Sates, and the tin occurrences of this country are so far only of geological or mineralogical interest, with indications of prospective value in a few instances." The most promising indications are those found in the Black Hills of Dakota.

RAILWAY SIGNALING. By W. McC. Grafton, Signal Engineer, Pennsylvania Lines West of Pittsburg. Bulletin of the University of Wisconsin, Madison, Wis.; Engineering Series, Vol. 1, No. 6. Paper; 8vo; pp. 38; illustrated; 35 cts.

This is a reprint of a lecture on the subject of signaling and interlocking, dealing almost exclusively with modern plant and modern practice. It is stated that there is no good wire compensator (which each signal plant manufacturer will, of course, deny), but this statement should have been supplemented to the effect that more than one road has found it entirely practicable to dispense with wire compensators, even for signals nearly 3,000 ft. from the tower. Mr. Grafton believes the present general system of colored lights to be the best (red for danger, white for safety, and green for caution), and states that the Pennsylvania lines are now experimenting with wire-glass colored lenses, to prevent a red lens from being broken, and so changing a danger to a clear signal.

CONTRACTORS' METHODS ON THE CHICAGO DRAINAGE CANAL.—Lidgerwood Mfg. Co., New York. Paper, 6 × 9½ ins., oblong; pp. 72; illustrated.

One of the firms which furnished a very large amount of machinery to the contractors of the Chicago Drainage Canal was the Lidgerwood Mfg. Co., and this handsome pamphlet describes and illustrates the various machines and methods of work where its supplies are used. The larger part of the pamphlet is devoted to the description and illustration of the traveling cableway, so much used in excavating the rock sections, and the remainder refers mostly to the use of their well-known hoisting engines. The description of the canal work is so fresh in the minds of the readers of Engineering News, that it is useless to review the pamphlet in any detail, but it may be said that by reading it one will get a very fair idea of the different methods of excavation adopted in this great work. Copies of the pamphlet may be had by addressing the Lidgerwood Mfg. Co.

BRIBERY AND BOODLING. Fraud, Hypocrisy and Humbug. Professional Charges and Pecuniary Ethics. By C. Baillairge, M. A., C. E., Quebec, Canada. Paper; 8vo; pp. 74.

This is a long and very interesting address delivered by Mr. Baillairge, as retiring President of the Province of Quebec Association of Architects, at the meeting on Oct. 2, 1895. The address was by no means confined to general statements, but gave interesting details of some of the proceedings in Canadian works, which come under the heads enumerated in the title of the address. It also discusses the relations between engineers or architects, their employers and the contractors who are doing their work.

TABLE OF CONTENTS IN CUBIC YARDS, with 100-ft. Intervals Between Areas. Sums of Areas from 1 to 14,000. Computed by P. H. Ashmead, C. E. Copyrighted, 1895, by the Sanitary District of Chicago. Octavo; 26 pp. of blueprints.

This is a blueprinted series of tables, intended to facilitate the calculation of quantities, included between ascertained end areas, by simple inspection. The operation is simple. For a section 100 ft. long the end areas are added together, and this sum is then found in the column of "sums of areas." Opposite to it, under the proper heading, is the volume desired in cubic yards. We are indebted for the copy of the table to Mr. E. R. Schanble, Asst. Engineer of the Sanitary District.

THE BEARING AND RESISTING STRENGTH OF STRUCTURES, and of That of Their Component Parts and Materials. By C. Baillairge, M. A., C. E., Quebec, Canada. Paper; 8vo; pp. 26.

This paper was read at the annual meeting of the Province of Quebec Association of Architects, Oct. 2, 1895, discussing the subject of the strength of buildings, especially those of considerable height. To the paper are appended tables of dimensions and cost of structural work of metal and masonry for buildings 1 to 20 stories high; weights per square foot of existing bridges, buildings, etc.; and the crushing strength of various building stones.

FORESTRY FOR FARMERS. By B. E. Fernow, Chief of the Bureau of Forestry, U. S. Department of Agriculture, Washington, D. C. Pamphlet; 8vo; pp. 40; illustrated.

This report is especially written for the benefit of farmers owning small timber tracts. It commences with a concise but excellent treatise on the growth of trees, and concludes with practical advice upon planting a forest and the general treatment and cultivation of a wood-lot. Under the latter head the farmer is advised as to the kind of trees and methods of planting, protection from wind, effect of light on trees, thinning of crop, etc.

WIDE TIRES. Laws of Certain States Relating to Their Use, and Other Pertinent Information. Compiled by Roy Stone, Special Agent in Charge of Road Inquiry. Department of Agriculture, Washington, D. C. Paper; 8vo; pp. 16.

The general information given on the subject of the relation of the width of wheel tires to road maintenance includes the conclusions arrived at by tests, to the effect that wide tires are best on soft ground, sod and hard roads, while narrow tires are best in soft mud and slush. Foreign regulations as to width of tires are also given.

THE EMPLOYMENT OF CONVICTS IN ROAD BUILDING. Compiled by Roy Stone, Special Agent in Charge of Road Inquiry. Department of Agriculture, Washington, D. C. Paper; 8vo; pp. 15.

This pamphlet is a compilation of abstracts of laws, published articles, etc., favoring the system of employing convicts on road work.

GOOD ROADS. Compiled by Roy Stone, Special Agent in Charge of Road Inquiry. Department of Agriculture, Washington, D. C. Paper; 8vo; pp. 24.

This is a compilation of extracts from the messages of governors of 23 states bearing on the importance of good roads and road maintenance.

NOVEMBER MAGAZINES.—In the "Review of Reviews" we find an interesting account of the late Louis Pasteur and his life work. The Governor of Alabama, Hon. W. C. Oates, writes in the "North American Review" on the "Industrial Development of the South." He speaks hopefully of the prosperity which seems to be steadily increasing in his state, and declares that its natural resources warrant the expectation that it will yet become the seat of many great manufacturing industries. He says of the Mineral Belt of the state:

> Where during the panic mines were closed, furnaces smokeless, mills and factories noiseless, now the mines are putting out every ton of coal possible, the factories, mills and foundries give forth the hum of engines, wheels and hammers.

Mr. Austin Corbin describes his long-cherished project for rapid transit across the Atlantic by express steamers plying between Fort Pond Bay, near the eastern end of Long Island, and Milford Haven, the most westerly part of Wales. We have commented on his paper in our editorial pages. A valuable paper in the same magazine by Hon. Robert P. Porter is entitled "The Municipal Spirit in England."

"The Improvement of the Civil Service" is described by Hon. W. G. Rice, of the United States Civil Service Commission. It will probably surprise many to learn that at present about 55,000 positions in the government service are filled by competitive examinations, and the salaries of these positions amount to $50,000,000 in round numbers.

In the "Forum" Mr. Ossian D. Ashley, President of the Wabash R. R. Co., writes on "The General Railroad Situation." He advocates the removal of the restriction against pooling contained in the Interstate Commerce Law, and in this, as most of our readers are aware, he is in agreement with practically all intelligent and unprejudiced students of the railway situation. Mr. Ashley goes out of his way, however, to attack the Interstate Commerce Law itself, whereas any one who fairly compares the present condition of things with that of a dozen years ago must acknowledge that the law has been of enormous value in lessening the discriminations between different persons and different places, which was once so common. Mr. Ashley also tries to make out that stock-watering has been much smaller than is ordinarily claimed. He seems to forget that the rule in American railway construction has been to "build on bonds," and the stock has been issued as a bonus for bond subscriptions, and to line the pockets of the original promotors.

This question is of comparatively little importance, however, as the water has undeniably been squeezed out of the original capitalization in almost every case. At the present time it is certain that the total annual payments to railway stock and bondholders in the United States represent no excessive return upon the actual value of the railways, if we measure that value on the basis of what would be required to replace them at the present time. Mr. Ashley's demand for state restriction of railway construction is a thoroughly commendable one. Capt. Alfred F. Mahan, U. S. N., writes on "The Navy as a Career." He points out the drawbacks as well as the advantages which are connected with the naval officer's life.

In "Appleton's Popular Science Monthly" a valuable series of articles is begun on "Principles of Taxation," by Hon. Daniel A. Wells. There is an excellent sketch of the late Alexander Dallas Bache, for many years Superintendent of the Coast Survey. In "Harper's" Julian Ralph gives a humorous account of travel in Nicaragua, which should interest any engineers who are looking forward to future employment on the canal. In "Scribner's" we find a portrait and brief biography of the late Prof. Von Helmholtz. "McClure's" begins this month a most interesting life of Lincoln. The illustrations from early prints and daguerrotypes do great credit to the enterprise and industry of the editors of this magazine.

TRADE PUBLICATIONS.

THE BALL NOZZLE AND ITS USES ILLUSTRATED. The American Ball Nozzle Co., 837-47 Broadway, New York City. 8vo.; pp. 12.

The various uses to which the ball nozzle may be put are described and illustrated in this catalogue. These are given as for fire hose, lawn sprinklers, fountains, air distributors, and tree and land irrigation. Process pictures are used for illustrations.

STONE DISTRIBUTING CART.—American Road Machine Co., Kennett Square, Pa. Paper; 5½ × 9 ins.; pp. 8; illustrated.

This cart is for distributing stone on road work, and is a four-wheel cart, dumping at the rear, and having an adjustable end door to regulate the delivery and spread the stone. The cart was illustrated and described in our issue of March 14, 1895.

TUBULAR WELL SUPPLIES.—The Cook Well Co., St. Louis, Mo. Pamphlet, 8 × 4½ ins.; pp. 48; illustrated.

This pamphlet describes and illustrates the various apparatus manufactured by this firm for driving deep wells and equipping them for operation. Various forms of pumping engines, jacks, strainers and tubing are described, and their adaptability for different uses explained.

THE PAINTING OF METALLIC SURFACES.—Harrison Bros. & So., Philadelphia, Chicago and New York. Pamphlet; pp. 6.

This is a brief but excellent presentation of the advantages of red-lead and linseed oil for the purposes intended, giving the requisites of a good paint for the preservation of iron and steel, and stating why the above materials are claimed to best meet these requirements.

ELEVATING, CONVEYING AND POWER-TRANSMISSION MACHINERY, Chain Belting and Steel-Cable Conveyors, etc.—Jeffrey Mfg. Co., Columbus, O. 12mo; pp. 144; illustrated.

This is a very fully illustrated catalogue, showing from photographs of appliances actually in use, the many forms and applications of the conveying plants manufactured by this company. Lists of sizes, permissible strains and prices are included. The company also makes tubular steel barrows, friction hoists, upright tubular boilers, the Jeffrey electric locomotive, and other tools and appliances used by contractors.

PUMPING ENGINES. General Catalogue of Worthington Pumping Engines, Steam Pumps and Hydraulic Machinery. Special Edition for the Cotton States and International Exposition, Atlanta, Ga., 1895.—Henry R. Worthington, New York. Paper; 5¾ × 6¾ ins.; pp. 95.

This catalogue contains a condensed, illustrated description of the numerous forms of the well-known steam pumps and pumping engines, condensers, etc., built by the firm of Henry R. Worthington. Among the novelties we notice a direct-connected electric pump for house service, built in three sizes, of capacities of 250, 500 and 1,000 gallons per hour, respectively, without any intermediate gearing between the armature and the pump shaft, and designed to run at 600 revolutions per minute; also a "dry vacuum" pump, and a self-cooling condenser, which produces a vacuum without a natural water supply. Worthington pumping engines are used in the Atlanta exhibition for the water supply of the grounds and electric fountain, and the firm makes a large and interesting exhibit in the Machinery Building.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Nov. 8.	Mud dredging (100,000 cu. yds.),	New York.	Oct. 24
Nov. 8.	Electric light bonds ($15,000),	London, O.	Oct. 10
Nov. 8.	Ventilating,	Baltimore, Md.	Oct. 31
Nov. 8.	Electrical supplies,	Philadelphia, Pa.	Nov. 7
Nov. 9.	Steel trestle bridge, Advertised, Eng. News, Oct. 24.	Ventura, Cal.	Oct. 24
Nov. 9.	Sewers,	Norwood, O.	Oct. 24
Nov. 9.	Iron or steel bridge,	Iola, Kan.	Oct. 24
Nov. 9.	Lead pipe,	Syracuse, N. Y.	Oct. 31
Nov. 9.	Bridge (60 ft. long),	Jacksonville, Ill.	Oct. 31
Nov. 9.	Pile bridge (360 ft.),	Great Neck, L. I.	Nov. 7
Nov. 9.	Bridge,	Rochester, Pa.	Nov. 7
Nov. 10.	Deep well, Advertised, Eng. News, Oct. 31.	Ames, Ia.	Oct. 31
Nov. 11.	Street lighting,	Springfield, Ill.	Oct. 17
Nov. 11.	Electric lighting,	Union Springs, Ala.	Oct. 17
Nov. 11.	Paving bonds,	Youngstown, O.	Oct. 17
Nov. 11.	Sewers,	Toledo, O.	Oct. 24
Nov. 11.	County jail,	Port Lavacu, Tex.	Oct. 24
Nov. 11.	Pipe sewers,	South Bend, Ind.	Oct. 24
Nov. 11.	Brick paving,	South Bend, Ind.	Oct. 24
Nov. 11.	Macadam road,	West Milford, N. J.	Oct. 31
Nov. 11.	Boiler house, etc.,	Atchison, Kan.	Oct. 31
Nov. 11.	Bonds ($1,000,000),	Duluth, Minn.	Oct. 31
Nov. 11.	Furniture, etc., Advertised, Eng. News, Oct. 31 and Nov. 7.	Fairfax, Va.	Oct. 31
Nov. 11.	Electrical equipment,	Brooklyn, N. Y.	Oct. 31
Nov. 11.	Pipe sewer, Advertised, Eng. News, Oct. 31 and Nov. 7.	Bloomfield, N. J.	Oct. 31
Nov. 11.	Sewers,	Syracuse, N. Y.	Nov. 7
Nov. 11.	Fire engine house,	Philadelphia.	Nov. 7
Nov. 11.	Sewers, etc.,	Brookline, Mass.	Nov. 7
Nov. 11.	Garbage removal,	Parkersburg, W. Va.	Nov. 7

Nov. 11. Electric light plant, Rome, N. Y.....Nov. 7
Nov. 11. Improving streets, Village Hill, O.....Nov. 7
Nov. 12. Swing bridge, Hamilton, O.....Oct. 24
Nov. 12. Pipe sewers, Buffalo, N. Y.....Oct. 31
Nov. 12. Sewers, New York, N. Y.....Oct. 31
Nov. 12. Lift-bridge, Utica, N. Y.....Nov. 7
Nov. 12. Bridge, Little Falls, N. Y.....Nov. 7
Nov. 12. Anchors for League Island navy yard...Nov. 7
Nov. 12. Coal for Key West naval station.....Nov. 7
Advertised, Eng. News, Nov. 7.
Nov. 12. Water-works system, Mt. Sterling, O....Nov. 7
Nov. 12. Electric light plant, Mt. Sterling, O.....Nov. 7
Nov. 12. Laying water service pipe, Chicago.....Nov. 7
Nov. 13. Sewers, New York, N. Y.....Nov. 7
Nov. 13. Asphalt paving, New York, N. Y.....Nov. 7
Nov. 13. Park work, New York, N. Y.....Nov. 7
Nov. 14. Elevator, Scranton, Pa.....Oct. 31
Advertised, Eng. News, Oct. 31 and Nov. 7.
Nov. 14. Iron bridge, New Orleans, La.....Oct. 31
Nov. 14. Street railway franchise, New York...Oct. 31
Nov. 14. Water-works system, St. Mary's, O.....Oct. 31
Advertised, Eng. News, Oct. 31 and Nov. 7.
Nov. 14. Brick and pipe sewers, Buffalo, N. Y...Oct. 31
Nov. 15. Swing bridge, Abbeville, La.....Oct. 10
Advertised, Eng. News, Oct. 10 to 24.
Nov. 15. Plans exposition bldgs., Nashville, Tenn..Oct. 17
Nov. 14. Iron bridge superstructure, Lowell, Mass.Nov. 7
Nov. 15. Sewer system, Champaign, Ill.....Oct. 17
Advertised, Eng. News, Oct. 17 and 24.
Nov. 15. Water-works system, Honey Brook, Pa..Oct. 24
Nov. 15. Bridge superstructure, Indianapolis, Ind.Nov. 7
Nov. 15. Sale of old material at Indian Head, Md.Nov. 7
Advertised, Eng. News, Nov. 7.
Nov. 15. Garbage crematory, Columbus Barracks..Nov. 7
Nov. 15. Boilers for electric plant, Washington...Nov. 7
Nov. 15. Asphalt paving, Brooklyn, N. Y.....Nov. 7
Nov. 16. Rebuilding bridge, Boise City, Idaho....Oct. 31
Nov. 16. Electric lighting, Wilkinsburg, Pa.....Oct. 31
Nov. 18. Powder (580,700 lbs.), Washington, D. C..Oct. 24
Nov. 18. County court house, Galveston, Tex....Oct. 31
Nov. 18. Electric lighting, Rome, N. Y.....Oct. 31
Nov. 18. Water bonds, Winton Place, O.....Oct. 31
Advertised, Eng. News, Sept. 12 to Oct. 31.
Nov. 19. Fixtures, etc., Rochester, N. Y.....Nov. 7
Nov. 19. Swing bridge, Hamilton, O.....Nov. 7
Nov. 20. Drainage canal work, Chicago, Ill.....Sept. 26
Advertised, Eng. News, Sept. 28 to Nov. 14.
Nov. 20. Steel bridge spans (3), Mobile, Ala.....Oct. 24
Advertised, Eng. News, Oct. 24 to Nov. 7.
Nov. 20. Macadam road (6 miles), Woodbury, N. J.Oct. 24
Advertised, Eng. News, Oct. 24.
Nov. 20. Plans water-works, etc., Lafayette, Ind.Nov. 7
Nov. 21. College building, Austin, Tex.....Oct. 31
Nov. 22. Brick paving, Marietta, O.....Oct. 31
Nov. 26. Sewers, Cincinnati, O.....Oct. 31
Nov. 26. Main sewer, Evansville, Ind. .....Nov. 7
Nov. 27. Granite pedestal, Washington, D. C....Oct. 31
Nov. 27. Stone paving, Cleveland, O.....Oct. 31
Nov. 28. Plumbing, etc., Chicago, Ill.....Nov. 7
Nov. 28. Water bonds, Norwood, Pa.....Nov. 7
Nov. 28. Sewer system, Norwood, Pa.....Nov. 7
Advertised, Eng. News, Nov. 7 and 14.
Nov. 28. Water-works system, Norwood, Pa.....Nov. 7
Advertised, Eng. News, Nov. 7 and 14.
Nov. 29. Street lighting, Cleveland, O.....Nov. 7
Advertised, Eng. News, Nov. 7.
Dec. 2. Sewers (22 miles), Mobile, Ala.....Sept. 19
Advertised, Eng. News, Aug. 29 to Oct. 24.
Dec. 2. Brick paving, Cincinnati, O.....Nov. 7
Dec. 3. Water-works system, Oxford, O.....Nov. 7
Advertised, Eng. News, Nov. 7 and 14.
Dec. 4. Water bonds, Middletown, Ind.....Nov. 7
Dec. 4. Approaches U. S. Bldg., Davenport, Ia...Nov. 7
Advertised, Eng. News, Nov. 7 and 14.
Dec. 4. Water-works, Middletown, Ind.....Nov. 7
Dec. 10. Garbage disposal, New York, N. Y.....Oct. 31
Dec. 17. Steel rails (4,000 tons), Ottawa, Ont....Oct. 24
Dec. 19. Boiler house, etc., Los Angeles, Cal.....Oct. 31
Jan. 7. Street ry. franchise, New Orleans, La.Oct. 17

RAILWAYS.

East of Chicago.

AKRON TRANSFER.—A press report states that this company is at work condemning property for its right of way. The road will connect Akron with Mogadore, O., about seven miles distant. Surveys have been made and some grading done. At Mogadore connection will be made with the Cleveland, Canton & Southern Ry.

GREENVILLE & HUDSON.—Incorporated in New Jersey Oct. 31 to build a railway in Hudson county; capital stock, $200,000; incorporators, John Hood, Camden, N. J.; D. G. Baird, Beverly, N. J.; Thos. W. Hulme and F. H. Lee, Mt. Holly, N. J.; Jas. F. Chaperkotter, Wm. Beidler, and M. M. Meredith, Philadelphia.

HAMILTON, BRANTFORD & PACIFIC JUNCTION.—A press report from Hamilton, Ont., states that application will be made at the next session of parliament for the incorporation of a railway under the above title, the intention being to build a line from a point on the Toronto, Hamilton & Buffalo, near Copetown, to a point on the Canadian Pacific near Schaw station. The total length of the road is about 12 miles.

HUDSON RIVER & WASHINGTON COUNTY.—A press report from Schenectady, N. Y., states that application has been made to the state railroad commissioners for permission to construct a steam railway under the above name between Greenwich and Schuylerville, N. Y. The length of the road will be eight miles.

INDIANA MIDLAND.—A press report from Indianapolis states that this company was incorporated Oct. 31 to build a railway, 100 miles long, from a point on the Wabash River 10 miles south of Terre Haute, transversely across the state to a point on the Ohio state line. Capital stock, $100,000. The principal stockholder is E. C. Rice, of St. Louis.

JACKSON & CINCINNATI.—F. B. Drake, Pres., Toledo, O., writes us that the entire right of way for the line now being built from Addison, Mich., to Jackson has been secured. Grading is now well under way, and all contracts for material have been let to Geo. M. Huss & Co., Woodstock, Mich. The route to the new road will pass through Woodstock and Clark's Lake. Ch. Engr., Isaac Dix, Addison, Mich.

LAKE SHORE & MICHIGAN SOUTHERN.—It is reported that plans are being made by this company for a large number of improvements between the Cleveland bridge and Air Line Junction, at Toledo, O., chief of which will be the new tunnel constructed under the Miami & Erie Canal. For years this tunnel has been too small for the immense traffic passing through Toledo, only two tracks being laid through it. The new tunnel will be made large enough to accommodate not less than four and perhaps six tracks.

LANCASTER & HAMDEN.—It is reported that a revival of this old Ohio project is in prospect, it being the intention to build three branches—one from Lancaster to Thurston and thence to Wellston, to connect with the Baltimore & Ohio; one from Laurelville to Kingston; and a third line to Point Pleasant, on the Ohio River. Pres., W. H. Stevenson, New York.

LEHIGH VALLEY.—An extension of the Easton & Northern division from its present terminus in Easton, Pa., to the main line at South Easton will soon be undertaken. The distance is about five miles.

MICHIGAN CENTRAL.—At the last session of the Michigan Railway Crossing Board maps of two proposed extensions of this road were submitted. One is to extend from Dearborn to Delray, the second is to tap the salt works in Wayne county.

NEW YORK, LAKE ERIE & WESTERN.—This company is contemplating extensive improvements in the way of double-tracking. It is reported that operations will commence first on the division between Kent and Marion, O. In addition to the laying of a second track, curves will be reduced and grades lessened.

PENNSYLVANIA.—The work of double-tracking the Pittsburg, Virginia & Charleston division, long delayed because of difficulty encountered in securing the necessary rights of way, has been commenced, and will be completed as soon as possible. With the purchase of a few more miles of right of way, the company will have a clear field from Pittsburg to Brownsville.

PHILADELPHIA, WESTCHESTER & LANCASTER.—Incorporated in Pennsylvania Nov. 4, to build a railway from Philadelphia to Lancaster, through the towns of Doe Run, Unionville and West Chester; capital stock, $1,000,000; Pres., Winslow Mason, Philadelphia; Secy., Mercer E. Gibson, Sharon Hill, Delaware county, Pa.

PORT HURON & LEXINGTON.—E. H. Brennan, Pres., Toledo, O., writes us that the construction of this road has been completed except tracklaying, the rights of way having been entirely secured and grading done. Further construction will follow the acquirement of the necessary capital. The route is 20 miles in length, and extends from Port Huron north along the shore of Lake Huron to Lexington.

RONDOUT & SOUTHWESTERN.—Business men of Kingston, N. Y., are interested in the promotion of a new line to extend from Kingston southwest through Ulster county. Funds for purchasing the right of way are being raised by subscription. Several preliminary surveys have been made.

ULSTER & DELAWARE.—We are informed, in confirmation of the report concerning this road, published in our issue of last week, that work has already begun upon the 3,000-ft. trestle extension to the Hudson River.

WASHINGTON & CHESAPEAKE.—A decree for the sale of this road and all its franchises has been signed by Judge Morris, in the U. S. Circuit Court. The American Security & Trust Co., of Washington, trustee of the bondholders of the road, was appointed by the decree to make the sale, which is to take place at Upper Marlboro, Prince George's county, Md., on Dec. 10. The road is 27 miles long, and extends from Washington to Chesapeake Beach, Calvert county, Md., where the company owns 700 acres of land. The rails have not been laid, but considerable grading has been done.

WILMINGTON & YORK.—A press report states that Wilmington (Del.) business men are considering the construction of a new railway between that city and York, Pa. The distance between the two cities is about 80 miles, and such a line would be without competition or opposition. The route suggested passes through Avondale, Quarryville and other business centers, and besides terminating at York, would have easy connection with Lancaster.

Southern.

BALTIMORE & OHIO.—Arrangements have been nearly perfected for building a short road from Buckhannon, W. Va., to the mouth of the Buckhannon River, opening up a portion of the state heretofore inaccessible and unexcelled in the richness of its mineral and timber resources. Hon. Thos. E. Davis, of Grafton, W. Va., is one of the principal promoters of the project.

GEORGIA & ALABAMA.—Surveyors are at work upon the extension from Lyons, Ga., to Savannah. The distance between these two points is about 65 miles. F. Y. Dabney has charge of the survey.

SAVANNAH & ATLANTIC.—This road was sold on Nov. 1 under decree of court for $250,000. It was bought by the Central R. R. of Georgia, and will be incorporated into its system. The road is 18 miles in length from Savannah to Tybee.

SOUTHERN.—This company is now making active preparations for the operation of its new line into Norfolk, via Greensboro, Raleigh and Selma, N. C. The ballasting of the track has been completed, heavy, new steel rails will be laid, and the line will be in operation in about five weeks. Nine new locomotives have been ordered for this service, and an order has been given the Cramps for a first-class, fast passenger steamship. This vessel will be put on a route to be established in connection with the Southern's new service, plying between Pinner's Point, Va., near Norfolk, and Baltimore. The company has purchased a site, and will at once erect large new railway, machine and other shops at Alexandria, Va.

Northwest.

BLOOMINGTON & CHICAGO.—According to a press report, the work of grading this Grant county (Wis.) road is to start immediately. Surveys have been made between Bloomington and Glen Haven.

CHICAGO & LAKE SUPERIOR.—E. J. Foster, Pres., Madison, Wis., writes us that the contract for 90 miles has been let to W. A. Welsh, of Chicago. The total projected length is 350 miles. Surveys have been completed from London, Wis., to Lake Geneva; grading and tracklaying are now in progress from London to Fort Atkinson. It is expected to push work north from London to Lake Superior in the spring.

CHICAGO & NORTHWESTERN.—H. W. Bathie, Div. Engr., Winona, Minn., writes that there is no prospect of an extension of the Redwood Falls branch to Marshall.

INDIANA, ILLINOIS & IOWA.—A press report states that this company has made arrangements to extend its road into Streator, Ill. At present it uses the Wabash tracks to gain entrance. It is thought the work will be completed in about six weeks, as there is very little grading to be done. Gen. Man., T. B. Shonts, 919 The Rookery, Chicago.

MANISTEE & GRAND RAPIDS.—An extension from the Chicago & West Michigan Crossing to Luther, 14 miles, is under construction. Grading will be completed this year and rails laid in the spring. Ch. Engr., E. W. Muenscher, Manistee, Mich.

MARQUETTE & IRON RANGE.—The incorporators of the new railway in northern Michigan, noted in our issue of last week, are Hiram R. Burt, Wm. Burt, Leander Palmer, Edward Palmer, Daniel Powell and Matthew Maynard, all of Marquette. It is reported that surveys have already been made, and that negotiations are in progress with the Ishpeming & Lake Superior to lay the tracks. Pres., Hiram R. Burt.

Southwest.

ATCHISON, TOPEKA & ST. JOSEPH.—B. P. Waggener, of Atchison, Kan., informs us that no construction work has been done as yet. A committee of the incorporators is investigating as to the right of way and most practicable route. It is the intention to build from Atchison to St. Joseph along the west side of the Missouri River. No board of directors has yet been organized.

CHICAGO, BURLINGTON & QUINCY.—A press report states that surveyors are now at work on the new line projected by this company from Grant City, Mo., to Rulo, Neb. The line will follow the old survey from Clyde to a point between Maryville, Mo., and Arkoe, Mo., through or near Graham and Maitland, and from the latter place as nearly straight as possible to the Burlington & Missouri River railway bridge at Rulo.

STATE LINE, STILLWATER & SOUTHEASTERN.—Frank J. Wikoff, Pres., Stillwater, Okla., writes us that this line is projected to extend from Cameron, Kan., to McAlester, Ind. T., a distance of 200 miles, passing through Pond Creek, Okla., and Stillwater, Okla. Surveys from Arnettville, a point on the Santa Fe, to Stillwater, have been completed, and part of the right of way secured. No contracts have been let. Ch. Engr., E. W. Hill, North Enid, Okla.

TEXAS & PACIFIC.—It is reported that Engineer-in-Charge Rusch has said the extension to Denison, Tex., will be ready for operation by Dec. 10.

WACO & THORNTON.—A railway project to connect Waco with the terra cotta, clay and coal mines near Thornton, is being actively pushed by Thornton and Waco business men. The route under consideration would tap a rich agricultural country, as well as one of considerable mineral resources. A further extension from Thornton to the Gulf is contemplated, passing through the towns of Madison, Huntsville, Cleveland and Sour Lake to Sabine Pass. The new line will probably be controlled by the Waco & Northwestern or its purchaser.

Rocky Mt. and Pacific.

CANYON CITY & CRIPPLE CREEK.—The incorporators of this road, mentioned in our last issue, are B. F. Rockafellow, Thos. S. Wells, F. A. Reynolds, J. H. Peabody, T. M. Marding, F. L. Bartlett, Henry Earle, C. W. Burrage, J. D. Harrison, Lyman Robison and J. J. Cone.

COLORADO, UTAH & WYOMING.—E. A. Clifford, P. O. box 799, Denver, Colo., writes us that preliminary surveys have been completed and a portion of the route has been profiled. The projected length is 400 miles. The main line extends from Rawlins, Wyo., through Craig, Colo., Steamboat Springs to Sulphur Springs, Colo. Spurs are projected from Craig to Ashley, Utah; from Steamboat Springs to Laramie, Wyo., and from Rawlins to Casper, Wyo. For further information address Wyoming Land Co., Barclay Bldg., Denver. Ch. Engr., F. J. Stanton, Cheyenne, Wyo.

FLAGSTAFF & CANYON.—W. W. Follett, Ch. Engr., Flagstaff, Ariz., writes us that the projected length of this road is 80 miles, from Flagstaff to Grand Canyon of the Colorado. Preliminary surveys are completed, including careful contour work, and location maps are now in preparation. Capital for construction has been partially secured. No contracts have been let, and no move in this direction will probably be made until spring. Pres., Jas. A. Fleming, Phoenix, Ariz.

FLORENCE SOUTHERN.—A press report states that the survey of this line from Florence to Silver Cliff, 35 miles, has been completed. The route passes through the heart of the mineral-bearing district of Custer county.

RIO GRANDE WESTERN.—D. C. Dodge, Gen. Man., has announced the intention of the company, according to press reports, to resume building operations in the spring, and to extend the line to Los Angeles over the route originally surveyed.

SOUTHERN PACIFIC.—It is reported that an extension is being surveyed from Port Los Angeles to Ventura, and that it is the intention of the company to commence construction as soon as the preliminary work is completed.

STREET AND ELECTRIC RAILWAYS.

BENNINGTON, VT.—E. D. Bennett, Bennington, writes us that the Bennington & Rutland Ry. Co. proposes to equip its five-mile branch, between this city and North Bennington, now operated by steam, with electricity, overhead span work. The passenger cars are to be equipped with four 50-HP. motors. Water-power will be used for generating the electricity. It is expected to have the road in operation by May 1. Pres., J. G. McCullough, North Bennington.

GLOUCESTER, MASS.—L. M. Haskins, A. Goodwin, Henri N. Woods and Charles H. Cleaves, of Rockport, Mass., have petitioned for an electric railway franchise from the Gloucester boundary line at Briar Neck to the Gloucester line at Lanesville, by way of South Mount Pleasant, Main and Granite Sts., Broadway, to Pigeon Cove. The capital stock is $125,000.

MILFORD, MASS.—C. W. Shippee, Milford, writes us that the Worcester Construction Co., Worcester, Mass., has completed about half of the Milford, Holliston & South Framingham Electric Ry., to be 12 miles long. Pres., W. B. Ferguson, 53 State St., Boston.

NEWTON, MASS.—The Newton Traction Co. has been incorporated to build an electric railway; capital stock, $1,000,000, with $3,400 paid in; incorporators, H. B.

Parker, Newton, Mass.; Louis Pfingst and J. Otis Wardwell, Boston; Mark P. Hillyer, New York, N. Y.; John N. Baldwin, Council Bluffs, Ia., and John J. Toffey, Jersey City, N. J.

SHREWSBURY, MASS.—The Shrewsbury St. Ry. Co. has petitioned for a franchise for its proposed electric road. S. F. Shaw, of Shrewsbury, is interested.

SANBORN, N. Y.—A company is making arrangements to begin the construction of an electric road 10 miles long from Ely to Erie, Sanborn and Pekin. Lewis T. Payne, a lawyer, of Pekin, is the vice-president of the company.

ALLEGHENY, PA.—The construction of an electric railway to the summit of Spring Hill is again being considered by the Spring Hill Electric Ry. Co., which was incorporated last year with a capital stock of $30,000. Frederick Erck, W. J. Beckford, J. H. Hespenheide and J. A. Hetzel are interested.

PORTSMOUTH, VA.—It is stated that M. W. Mason proposes to extend an electric railway in which he is interested to Prentis Place, a suburb of this city.

SCRANTON, PA.—The Dunmore St. Ry. Co. was incorporated Nov. 4, with a capital stock of $30,000, $5,000 of which is paid in; Pres., John M. Burke, Scranton.

JACKSONVILLE, FLA.—It is reported that a company will soon be incorporated to construct an electric railway 13 miles long from this city to Orange Park. J. F. Eldridge, Treas. Orange Park, Fla., is interested.

GEORGETOWN, KY.—C. H. Williams, Ch. Engr., Centerville, Ga., writes us that the Georgetown R. R. Co. will soon construct its own electric railway, four miles long, between Georgetown and Berlin, at an estimated cost of $60,000. Four passenger cars and a freight motor car have been purchased. The capital stock is $10,000, and $50,000 in bonds have been sold. Pres., S. M. Davis, Georgetown, Ky.

CINCINNATI, O.—A. Hickenlooper, Vice-Pres., Cincinnati, writes us that the surveys have been completed and the right of way secured between Cincinnati and Hamilton for the Cincinnati, Hamilton, Middleton & Dayton St. R. R. The capital for the construction can be secured when needed. The construction of this proposed electric road, 18 miles long, will be begun in about six months. Pres., L. C. Weir, Pres. Adams Express Co., New York, N. Y.; Ch. Engr., Horace Wood, Cincinnati.

LIMA, O.—Wm. H. Hartman, Man., Lima, writes us as follows concerning the Lima & Piqua Electric Ry., which was organized Oct. 28: The right of way on public highways has been granted through several counties for an electric railway 52 miles long from Lima to Piqua, O. A passenger car will run every two hours each way, with a local freight car each way daily, and ultimately will run a through freight train each way daily from 15 to 20 loaded cars, as 20 miles of the line is isolated from railways. The road will also carry mail and express matter. The company proposes to build a first-class road in every particular as to track and equipment, with not less than a 70-lb. steel T-rail. The company is ready to communicate with contractors and engineers for survey estimates and construction. The company is particularly anxious to complete the first ten miles of the line from Wapakoneta to St. Mary's by January, and it would be glad to hear from contractors who are financially able to complete their contracts promptly.

FORT WAYNE, IND.—The Fort Wayne & Hicksville Electric Ry. Co. has petitioned for a franchise. P. A. Randall is interested.

DETROIT, MICH.—The Detroit Citizens' St. Ry. Co. has had plans prepared by the company's engineer for a brick street car house, 400 × 74 ft., on Dragoon Ave., between Cadet and Dix Aves., and another 300 × 100 ft. on Commonwealth Ave., between Stanley Ave. and the Grand Trunk Ry. The two buildings will cost $20,000.

MONROE, MICH.—The Monroe St. Ry. Co. is making surveys for its electric road. W. C. Sterling & Son have been awarded the contract for the ties, according to reports.

CHICAGO, ILL.—It is stated that the construction of the Chicago & Englewood Electric Ry. will soon be begun. W. V. Jacobs is interested.

CHICAGO, ILL.—Press reports state as follows: J. C. Shaffer, who is at the head of a syndicate of Eastern capitalists in negotiating for the purchase of the franchises and property of the Englewood & Chicago Electric Ry. Co. and the Chicago & Morgan Park St. Ry. Co., has announced that all the details of the proposition were consummated and the control of this property has passed into the hands of Mr. Shaffer and his associates in New York and Philadelphia, who are members of the Electric Storage Battery Co., of Philadelphia. Among these are August Belmont, J. L. Waterbury, of the Manhattan Trust Co.; President Griscom, of the International Navigation Co.; Isaac T. Rice, attorney and railroad financier, and W. W. Gibbs, of the Consolidated Gas Co., of Philadelphia. One line has not been completed, and the other not yet started, but the new owners will build a suburban system 100 miles long, with 100 storage battery cars.

PEORIA, ILL.—The Seiberling Mfg. Co. has awarded the contract for the rails for the proposed electric railway in which it is interested to H. C. Finkiestein, according to reports.

MADISON, WIS.—William T. Fish and H. C. Adams have secured a franchise from Madison for an electric railway two miles long from Camp Randall to Wingra Park, thence to Greenbush, and from there back to the city, connecting with the present line near the Illinois Central depot.

OSHKOSH, WIS.—A press report from Toledo, O., states that J. K. Tillotson, of Toledo, has just closed an electric railway deal at Oshkosh. Charles E. W. Smith, the representative of G. F. Melton & Co., of New York, has been in Toledo for several days closing up the contract for his house. The contract is for the entire construction of 15 miles of electric railway in Oshkosh and 26 miles of suburban line, connecting with the towns of Neenah, Chute, Combined Locks and Kaukauna. The construction contracts are for $350,000, and other contracts call for $155,000.

WHITE FISH BAY, WIS.—T. W. Williams, H. K. Curtis, Sentinel Bldg., Milwaukee, and Henry King and Max Zabel have been appointed a committee to consider the question of constructing an electric road to Mineral Spring Park.

MANKATO, MINN.—S. R. Snow, Man. Saulpaugh House, and C. L. Alleman, Pres. Commercial Club, of this city, are interested in a projected electric road and light plant for this city and vicinity.

KANSAS CITY, MO.—The Metropolitan St. Ry. Co. is about to petition the council for a franchise for extending its electric road on Wyandotte St. Gen. Man., W. H. Holmes.

OAKLAND, CAL.—It is stated that the construction of the proposed road between Haywards and Alvarado will be begun at once. Felix Chappiet, of Oakland; D. Chisholm and Geo. Oakes, of Haywards, and W. R. Ellis, of Livermore, are interested.

PASADENA, CAL.—The Pasadena & Altadena Ry. Co. has been incorporated to build an electric road; capital stock, $100,000, with $6,000 paid in; and the Mount Lowe Ry. Co. has been incorporated to build an electric road three miles long up Mount Lowe; capital stock, $100,000, with $6,000 paid in; directors for both companies, T. S. C. Lowe, Leon P. Lowe, Herbert P. Browne and L. A. Lowe, of Pasadena.

SAN FRANCISCO, CAL.—The Market St. Ry. Co. has decided to extend its electric road on three streets.

SAN JOSE, CAL.—Arrangements are being made to begin the construction of the proposed electric road to Saratoga. J. P. Fry and Frank Stock are interested.

MONTREAL, QUE.—Edmund Bristol, 103 Bay St., Toronto, Ont., writes us that the Canadian Electric Ry. & Power Co. has applied to Parliament for a charter for an electric road from Windsor, Ont., to Montreal, Que. The parties associated in the enterprise are men of large capital.

ELECTRIC LIGHT AND POWER.

PAWTUCKET, R. I.—The Interstate Consolidated R. R. Co. has awarded the contract for supplying the road with electric power to the Bridge Mill Power Co., of Pawtucket. The latter company awarded the contract for constructing its power house, 100 × 50 ft., about a month ago to W. A. Chapman & Co., of Boston. The plant will be completed, probably, in January, and will have a capacity of 1,200 HP., the water power for which will be taken from the Blackstone River.

LITTLE VALLEY, N. Y.—S. L. Suretland, Secy. Water Comrs., writes us that the village has voted to sell $7,000 in bonds for an electric light plant, to be put in at once. The power house will be of brick. The village is to put in 10 or 15 arc lights for street lighting, but the plant will have a capacity of about 700 incandescent lights.

NEW ROCHELLE, N. Y.—J. Abel, of Neptune Park, and J. Wilkins, of Highland Park, are interested in a proposed electric light plant for this place.

ROME, N. Y.—Bids are asked until Nov. 11 for installing an electric light plant in the Rome State Custodian Asylum. I. G. Perry, State Arch., Albany; E. S. Williams, Pres. Bd. Managers, Rome.

PASSAIC, N. J.—It is stated that the Passaic Lighting Co. has decided to erect works at Passaic St. and Columbia Ave., to cost about $100,000.

PALMYRA, PA.—We are informed that the estimated cost of an electric light plant is under discussion. Address U. H. Gore, Palmyra.

PHILADELPHIA, PA.—Bids are asked until Nov. 8 for furnishing electrical supplies to the department of charities at 34th and Pine Sts. Wm. H. Lambert, Pres. Bureau of Charities.

NEW CASTLE, DEL.—C. Edwin Eckles, Cy. Clk., writes us that the city has contracted with the gas company to light the city with the Welsbach system, having abandoned the project of lighting with electricity at present.

CONOWINGO, MD.—James H. Harlow, Times Bldg., Pittsburg, Pa., it is reported will prepare plans for a power plant for the Susquehanna River Electric Co., of this place. Bids will be asked in about 25 days for the construction of the hydraulic work. Consult. Engr., Clemens Hershel, 2 Wall St., New York, N. Y.

BALTIMORE, MD.—Ferdinand C. Latrobe, Mayor, writes us that it has been suggested to the park commission that it would probably be more economical for the commission to establish its own electric plant for lighting Druid Hill Park, and also another plant in Patterson Park, than paying, as is now done, the price charged by electric light companies for lights. No steps whatever have been taken thus far to carry this suggestion into effect. Should the park commission decide to establish such a plant, bids will be asked for the dynamos, engine, etc. The city has its own electric plant for lighting the jail, and also the city almshouse, the success of which encourages the park commission to think it might be economical to have an independent plant for the different parks of this city.

WASHINGTON, D. C.—Bids are asked until Nov. 15 for furnishing two horizontal tubular boilers for use in connection with the electric light plant now being installed at the Government Hospital for the Insane. Hoke Smith, Secretary Interior.

NORTH WILKESBORO, N. C.—W. F. Trogdon, of this place is interested in a project to transmit 100 E. HP. 1½ miles.

TAMPA, FLA.—It is stated that bids are wanted for furnishing about 200 incandescent lights. P. G. Wall, Jr., Chn. Com., Tampa.

LAFAYETTE, LA.—Bids are asked until Nov. 20 for surveys, maps and estimates, for an electric light plant and water-works. Address T. M. Blossat, Lafayette.

CLEVELAND, O.—A company is about to be organized to light the west side by electricity. Chas. Pegler, 485 Pearl St., Cleveland, is interested.

CLEVELAND, O.—Bids are asked until Nov. 20 for electric, gas, and oil or vapor street lighting, as described in our advertising columns. D. E. Wright, Dir. Pub. Wks.

FOSTORIA, O.—The committee is preparing specifications, and will soon advertise for bids for lighting the streets, according to reports. John P. Force, Cy. Engr.

MOUNT STERLING, O.—Bids are asked until Nov. 12 for furnishing materials and constructing an electric light plant, as described in our advertising columns Sept. 12. E. P. Roberts & Co., Engrs., Cleveland; John W. Hanawalt, Cy. Clk.

DANVILLE, IND.—It is stated that J. S. Richards & Co., of Marshall, Ill., has been granted a franchise for an electric light plant, to be in operation by January. Charles Z. Cook, Town Clk.

MADISON, IND.—The city desires to sell or lease its existing electric light plant, the purchaser or lessee to build about three miles of electric railway. Ellison D. McGuire, Mayor.

CORUNNA, MICH.—Wm. A. Knight, Cy. Clk., writes us that the city voted Oct. 24 to issue $3,000 in bonds for electric lights and water-works, but that nothing further in the matter has been done.

DURAND, MICH.—It is stated that the citizens voted Oct. 25 on the question of issuing bonds for an electric light plant.

DAVENPORT, IA.—Press reports state that the U. S. government has made arrangements with the People's Power Co. for the erection of a wing dam just above the government island. Thirty-one turbine wheels will be erected, and two 1,000-HP. engines will be put in by the People's Power Co., in addition to the 700-HP. engines already in operation. This improvement will cost about $150,000, and will revolutionize the manufacturing industries of Davenport, Rock Island and Moline.

BIWABIK, MINN.—It is reported that an electric light plant is about to be built.

BAZILE MILLS, NEB.—Geo. A. Brooks has contracted for an electric light plant, work on which will soon be begun.

DEXTER, MO.—E. L. Hawks, of Puxico, and Grant Gillespie, of Dexter, have been granted a 10-year electric light franchise.

TOPEKA, KAN.—A resolution has been adopted by the council, according to reports, instructing the city clerk to advertise for bids for machinery to increase the capacity of the city lighting plant.

SACRAMENTO, CAL.—Dr. Charles Vanderden, representing the South Cuba Canal Co., has petitioned the board of supervisors for a franchise for the Central California Electric Co. to transmit power through the county to Sacramento, according to reports.

NEW COMPANIES.—Standard Brass & Electric Co., St. Paul, Minn.; $50,000; J. W. Jaggar, Jacob Heilbron, Theodore Grutting.

Houston Electric Co., Kansas City, Mo.; $10,000; C. A. Ross, W. H. Blood, L. P. Boulelake.

Monroe City Electric Light Co., Monroe City, Mo.; $10,000; William Wood, E. P. Melson, W. T. Ragland.

Troy Mining, Power & Improvement Co., Spokane, Wash.; $100,000; R. Russell, Fred K. McBroom, W. J. C. Wakefield.

Oakdale Electric Light, Heat & Power Co., Oakdale, Pa.; $8,000, with $800 paid in; Treas., Wilfred P. Bryson, Oakdale.

Nortonville Electric Light, Heat & Power Co., Nortonville, Kan.; John Campbell, J. W. Harris, L. F. Randolph, A. J. Perry, C. C. McCarthy, John Standish, J. L. Elmore.

Plattsburg Light, Heat & Power Co., Plattsburg, N. Y., has increased its capital stock from $100,000 to $125,000; H. G. Runkle, G. M. Cole, H. E. Bullard, A. E. Reynolds.

Standard Electric Storage Battery Co., New York, N. Y.; $5,000,000, with $1,000 paid in; to manufacture storage batteries and other appliances; Ernest Thalmann, 46 Wall St.; R. T. McDonald, 115 Broadway; James Warwick, 36 Wall St., all of New York; E. A. MacClean, Glen Ridge, N. J.

BRIDGES.

LOWELL, MASS.—Bids are asked until Nov. 14 for the iron superstructure for the Moody St. bridge. Geo. Bowers, Cy. Engr.; Daniel H. Varnum, Chn. St. Com.

GREAT NECK, N. Y.—Bids will be received by the highway commissioners of North Hempstead at Kane's Hotel in this village Nov. 9 for building a pile bridge 360 ft. long across Udall's Pond.

LITTLE FALLS, N. Y.—Bids are asked until Nov. 12 for constructing a bridge over the canal at German St. Geo. W. Aldridge, State Supt. Pub. Wks., Albany.

MOUNT KISCO, N.Y.—The sub-committee of the board of supervisors has been directed to ask for bids for constructing a new iron bridge over Croton Lake, to cost about $8,000. Engr., J. Henry Carpenter, White Plains, N. Y.

UTICA, N. Y.—Bids are asked until Nov. 12 for changing the fixed bridge at Genesee St. to a lift bridge. Geo. W. Aldridge, Supt. Pub. Wks., Albany.

CARBONDALE, PA.—Walter Frick, Cy. Engr., writes us that the city expects to build four plate girder bridges, to cost about $6,000 each, and is raising the money to go on with the work by issuing bonds.

ROCHESTER, PA.—Bids are asked until Nov. 9 for constructing a bridge across the Ohio River for the Ohio River Bridge Co., of this city. C. A. Danalt, Secy., writes us that the plans have been prepared, and also the necessary amount of the capital stock sold to raise the money for the construction, except $100,000, which will be secured by the sale of bonds. Engr., E. K. Morse, Penn Bldg., Pittsburg, Pa.

BLUFF CITY, TENN.—T. B. Jenkins, Secy. Com., writes us that the contract for the superstructure for a new steel bridge, 360 ft. long, has been awarded to Morris Cope, of Chattanooga, Tenn., General Agent of the New Columbus Bridge Co., of Columbus, O.

ASHLAND, KY.—It is stated that Maj. Samuel Bigstoff, Gen. Man. South Covington & Cincinnati St. Ry Co., Newport, Ky., has secured the option on a charter for a railway bridge over the Ohio River, between this city and Ironton, O. A company is being organized to build a combined railway and highway bridge as soon as possible.

CINCINNATI, O.—The county commissioners have directed Frank S. Krug, County Engr., to prepare plans for four bridges and a culvert, according to reports.

DAYTON, O.—F. W. Turner, Cy. Engr., is preparing plans and estimates for a new bridge on Main St., but nothing more can be done until the legislature meets.

MIDDLETOWN, O.—Bids are asked until Nov. 19 for constructing an iron and steel hoist or swing bridge, 60 ft. long and 30 ft. wide, over the Miami & Erie Canal, on the Franklin road, Middletown, and for constructing the abutments for the same. Frank X. Duerr, County Audr., Hamilton, O.

INDIANAPOLIS, IND.—Bids are asked until Nov. 15 for the superstructure for the Meridian St. bridge. The bridge has two girders 78 × 7 ft. 6 ins. × 7-16 in., with floor beams 27 ft. 9 ins. × 2 ft. 11½ ins. × 5-16 in., stringers of 12-in. I-beams, 38.2 lbs. a foot, and double 1½-in. oak flooring. Also brackets for two sidewalks,

each 6 ft. clear, with stringers of one 7-in. I and two 7-in. channel-beams, and 2-in. plank floor and Memphis rail. The following bids were recently received for the superstructure for this bridge, but were rejected on account of being considered too high:

Iron Substructure Co., Columbus, O.	$5,200
Toledo Bridge Co., Toledo, O.	5,125
Youngstown Bridge Co., Youngstown, O.	5,100
Lafayette Bridge Co., Lafayette, Ind.	5,100
J. D. Adams & Co., Indianapolis, Ind.	5,018
C. F. Hunt Co., Indianapolis	5,010
Wisconsin Bridge & Iron Works, Milwaukee	5,008
J. B. Nelson, Indianapolis	4,980
Wrought Iron Bridge Co., Canton, O.	4,948

CHICAGO, ILL.—Wm. M. Hughes, 768 The Rookery, Chicago, has been engaged as consulting engineer by the department of public works to prepare plans and specifications and supervise the construction of a 121-ft. lift bridge for the city at North Halsted St. The structure in general will be similar to the Van Buren St. bridge, described in Engineering News, Feb. 21, 1895.

LAFAYETTE, IND.—W. K. Eldridge, Cy. Engr., informs us that the following bids were received for constructing the 18th St. bridge, which will contain three 60-ft. spans:

*Lafayette Bridge Co., Lafayette, Ind.	$5,705
Wisconsin Bridge Co., Milwaukee, Wis.	5,850
Penn Bridge Co., Beaver Falls, Pa.	5,900
Attica Bridge Co., Attica, Ind.	6,100
Youngstown Bridge Co., Youngstown, O.	6,500
King Iron Bridge Co., Cleveland, O.	6,627
C. F. Hunt Co., Indianapolis, Ind.	6,700
The Iron Substructure Co., Columbus, O.	6,875
Brackett Bridge Co., Cincinnati, O.	7,000
Champion Bridge Co., Wilmington, O.	7,100
Masonry Work.	
*Carl Heide, Lafayette, Ind.	$1,803
Williamsport Stone Co., Williamsport, Ind.	1,856
Joshua Chew, Lafayette, Ind.	2,051
Thomas Davis, Lafayette, Ind.	2,110
Nelson Johnson, Lafayette, Ind.	2,150
F. J. Bernhart, Lafayette, Ind.	2,154
George A. Harrisson, Lafayette, Ind.	2,300

*Awarded contract.

DUBUQUE, IA.—W. H. Knowlton, Cy. Engr., writes us that private parties are trying to secure subscriptions for a company to build a bridge over the Mississippi River at Eagle Point. The city is asked to donate $25,000 to aid in the construction of the bridge, which is estimated to cost $135,000.

OAKLAND, CAL.—Press reports state that the board of supervisors has awarded a contract to Cotton Bros. & Co. to construct a steel bridge 210 ft. long across the Arroyo Valley on the road from Pleasanton to Mission San Jose at $6,150.

STOCKTON, CAL.—Press reports state that the directors of the San Francisco & San Joaquin R. R. Co. will open bids at their next meeting for piling, piers and bridge lumber for bridges and trestles over the Tuolumne River and the bed of Dry Creek. The Tuolumne bridge will be 1,300 ft. long and 40 ft. high, and consist of piers for the support of trusses of wood and iron and a long trestle on either side from the bank to the stream. The Dry Creek bridge will be about 800 ft. long, with one long span and trestle approaches. Builders are working on the Stanislaus River bridge, and also on the steel drawbridge in Stockton over Mormon Channel, and other crossings over channels near that city. With the last two bridges contracted for all of that class of work on the Valley railway will have been given out to builders over a distance of 33 miles from the Stockton terminus.

SOREL, QUE.—It is reported that the railway committee of the privy council of Montreal has approved of the site for the new railway bridge over the Richelieu River at Sorel, and the work will be begun at once, Mr. McCarthy being engineer.

BUILDINGS.

PITTSFIELD, MASS.—H. W. Partridge, Secy. Bldg. Com., Pittsburg, informs us that the following bids have been received for constructing a new high school building:

McFaul & Hart, Holyoke, Mass.	$132,974
*James Clifford, Lenox, Mass.	142,000
H. C. Wood, Westfield, Mass.	114,343
Hopkins & Roberts, 245 Broadway, New York.	112,400
A. W. Burritt Co., Bridgeport, Conn.	124,690
Enterprise Co., 114 Fifth Ave., New York.	114,000
Darling Bros., Decker & Hall, Worcester, Mass.	116,000
Dodge & Devanny, Pittsfield, Mass.	114,400

*Including terra cotta; all others are without terra cotta.

SPRINGFIELD, MASS.—Hartwell & Richardson, of Boston, have prepared plans for a $250,000 school building for this city, according to reports.

BROOKLYN, N. Y.—J. W. Naughton, 131 Livingston St., Brooklyn, has prepared plans for a school building, 115 × 101 ft., to cot $112,000.

NEW YORK, N. Y.—It is stated that the secretary of the treasury has rejected the bids for iron and steel work of the New York warehouse, as the lowest bid made was regarded as excessively high. New bids will be asked. The bids were published in our issue of last week. Post & McCord, of New York, were the lowest bidders, at $419,900.

ROCHESTER, N. Y.—Bids are asked until Nov. 19 for fixtures and fittings for the court house of Monroe county. Arch., J. Foster Warner, 1036 Granite Bldg., Rochester. Lyman M. Otis, Chn. Bldg. Com., Rochester.

RAHWAY, N. J.—It is stated that Enoch W. Hooper, of Trenton, N. J., was awarded the contract at $66,300 for building the northwest wing of the state reformatory. Arch., John R. Thomas, 160 Broadway, New York.

PHILADELPHIA, PA.—Bids are asked until Nov. 11 for the erection of a fire engine house at Sixth and Sansom Sts. A. M. Beltler, Dir. Dept. Pub. Safety.

PHILADELPHIA, PA.—The supervising architect at Washington, D. C., has been directed to make arrangements to begin the construction of the proposed new mint building in this city in the spring.

PITTSBURG, PA.—Chess & Hall will build a six-story brick business block, 40 × 110 ft., on 10th St.

PITTSBURG, PA.—W. S. Fraser has prepared plans for a six-story brick and stone building, 108 × 60 ft., to cost $60,000, on Penn Ave. for Chas. Lockhart.

CHARLESTON, S. C.—The following bids were received Oct. 25 for the approaches to the U. S. public building in this city, as advertised in Engineering News; Wm. Martin Aiken, Supervising Arch., Washington, D. C.:

L. L. Leach & Son, Chicago, Ill., $9,945; amount for substituting artificial stone for bluestone sidewalks, $8,000; time, 3 months.

E. D. Briggs, Aurora, Ill., $10,908 and $9,026; time, 90 working days.

Stewart Contracting Co., Columbia, S. C., $7,981 and $7,075; time, 3 months.

Cumberland Buff Stone Co., Charleston, S. C., $9,000 and $8,000; time, 3 months.

Winnsboro Granite Co., Charleston, S. C., $10,079 and $8,936; time, 3 months.

Owen Patterson, Baltimore, Md., $11,080 and $10,157; time, 3 months.

Bartley M. Yose and M. J. Ruddy, Scranton, Pa., the plumbing and other interior work for the ap- $9,353 and $8,080; time, 85 days.

CLEVELAND, O.—It is proposed to construct an exposition building 310 × 185 ft. in this city to seat 22,000, and to cost about $350,000. J. C. McWalters and Henry W. Elliott are interested.

CHICAGO, ILL.—Bids are asked until Nov. 28 for the plumbing and other interior work for the appraisers' stores in this city. Frank G. Hayne, Custodian, U. S. Appraisers' Stores.

PEORIA, ILL.—Architects have been engaged to prepare plans for a new insane asylum building. The commissioners have been granted $100,000 to begin the work. It is stated that about $2,000,000 will later on be spent in the construction of the buildings. John Finley, Chn. Comrs., Peoria.

ST. JOSEPH, MO.—It is stated that the commissioners of Buchanan county will be asked to hold an election to vote on the question of issuing $100,000 in bonds for a new jail.

ST. LOUIS, MO.—Varney & Woolryck have prepared plans for an eight-story hotel 128 × 60 ft., to contain 175 rooms, and to be owned by Wm. H. Stevenson.

DAVENPORT, IA.—Bids are asked until Dec. 4 for constructing the approaches to the U. S. public building in this city, as stated in our advertising columns. Wm. Martin Aiken, Supervising Arch., Washington, D. C.

FRESNO, CAL.—John M. Curtis, 126 Kearney St., San Francisco, has prepared plans for a county court house, to cost $50,000. T. G. Hart, County Clk.

WATER-WORKS.

BAR HARBOR, ME.—The Bar Harbor Water Co. has awarded the contract for building its new dam to John Cashman, of Quincy, Mass., according to a local paper, and the construction was commenced Oct. 29.

WATERBURY, VT.—Joel Foster, of Montpelier, has prepared three estimates for works, the supply being from different sources.

TURNER'S FALLS, MASS.—The residents of Montague City have offered to guarantee 8% interest on the cost of extending the water service to that place, which is estimated to cost $4,680.

WINCHENDON, MASS.—Specifications for a 500,000-gallon reservoir are now being printed. No contracts for the new works have yet been awarded. Water supply will be from wells; population, 4,491; Engr., F. L. Fuller, Boston. W. C. Corey, Secy. Comrs.

LAKEVILLE, CONN.—The contract for extending the mains to Salisbury has been awarded to F. S. Cadwell, of New Britain.

NEW HAVEN, CONN.—The New Haven Water Co. is reported as planning improvements of its water supply, which include the construction of 1,500 to 2,000 ft. of tunnel 6 ft. in diameter.

ANGELICA, N. Y.—It is reported that D. P. Richardson, H. S. Hastings and J. S. Rockwell have offered to assign the franchise granted them some time ago to the village and that there is talk of constructing a municipal plant.

BROOKLYN, N. Y.—The commissioner of city works has asked the aldermen for $60,000 for extending the water mains.

OLEAN, N. Y.—The water-works election at North Olean has been decided illegal, and a new election will be held Nov. 13. James Norton, Clk.; John H. Kane, Pres.

FORT ANN, N. Y.—C. E. Woodard, Village Clk., writes us that the reports in the daily papers are incorrect, and that no steps are being taken for the construction of works for this village.

SCHENECTADY, N. Y.—The contract for a pumping station has been awarded to John McEncroe, and that for a stone water tower to John McDermott. The bids were received Oct. 24, and were as follows:

	Pumping station.	Water tower.
John McEncroe, Schenectady	$26,593	.....
Andrew Kirnim, Schenectady	32,014	$21,446
W. G. Jones, Rome, N. Y.	27,106	18,351
John McDermott, Schenectady	.....	19,546
John Twomey, Schenectady	.....	20,012

LONG ISLAND CITY, N. Y.—P. J. Gleason is reported as reviving the Woodside water project.

TULLY, N. Y.—The board of water commissioners opened the following bids Nov. 4 for constructing water-works:

M. B. Birdseye, Fayetteville, N. Y.	$12,773
W. T. O'Connor & Co., Syracuse, N. Y.	13,280
John Morrell, Mohawk, N. Y.	13,314
C. T. Snavin, Syracuse, N. Y.	13,960

DECKERTOWN, N. J.—We are informed that Fred J. Knight, of Monroe, N. Y., has been engaged to make preliminary surveys and estimates, in order that the question of constructing municipal works may be brought before the people for a decision. Louis L. Tribus, 84 Warren St., New York, was retained by some citizens in July, and his report has just been published. C. H. Smith, of Middletown, N. Y., has also recently made surveys for a water supply at this place. Levitt J. Loomis, Chn. Com.

SEA ISLE CITY, N. J.—The Sea Isle City Electric Light, Power & Water Co. is reported as about to receive bids for the construction of works.

SPLIT ROCK, N. J.—A press report states that works can be constructed at this place at a comparatively small cost, and that a franchise would probably be granted to any company desiring to put in a water-works plant.

EASTON, PA.—The South Side Spring Water Co. was incorporated Oct. 31 to operate in Palmer township; capital stock, $15,000, commencing with $1,500; Treas., O. J. Mutchler, of Glendon, Pa.

GREENSBURG, PA.—A press report states that the Westmoreland Water Co., at a recent meeting decided to begin work soon on the proposed reservoir, noted last week. Murray Forbes, Man.

GROVE CITY, PA.—The Grove City Water Co., recently incorporated. Is reported about to construct works. Pres., I. C. Keller; Secy., W. J. Harshaw.

LEBANON, PA.—We are informed that the water commissioners are about to drill an artesian well at dam No. 2 of the South Mountain Reservoir for an additional water supply. Geo. W. Hayes is city engineer.

McKEESPORT, PA.—The commissioners are discussing a proposed water supply from artesian wells, at an estimated cost of about $30,000, according to reports.

NORWOOD, PA.—Bids are asked until Nov. 28 for the purchase of $30,000 in bonds issued for the construction of water-works and sewers; T. F. Creeger, Chn. Com., Norwood, Pa., or 145 North 4th St., Philadelphia.

NORWOOD, PA.—Bids are asked until Nov. 28 for constructing a system of water-works, as stated in our advertising columns. Enon M. Harris, Jr., Engr., Collingdale, Pa.; C. M. Walton, Chn. Com.

PHILADELPHIA, PA.—Ordinances have been adopted for laying water pipe in over 30 streets.

PITTSBURG, PA.—The council's committee on charities has authorized a contract with the St. Clair Water Co. for a water supply at Marshalsea, the company agreeing to furnish 100,000 gallons a day at 7 cts. per 1,000 gallons for the first year, 6 cts. for the second year, and 5 cts. thereafter.

SUSQUEHANNA, PA.—Charles Boyden has the contract for excavating and filling for securing a new water supply from a large spring 1½ miles from the new reservoir. The company will lay the pipe.

WARREN, PA.—A petition is being circulated asking that municipal works be constructed, estimated to cost from $75,000 to $100,000.

ATLANTA, GA.—The construction of the new water main, estimated to cost $50,000, noted last week, has been commenced under the direction of the city engineer.

DUBLIN, GA.—It is stated that an election will soon be held to vote an appropriation of $25,000 for a water and electric light plant.

ST. AUGUSTINE, FLA.—F. W. Bruce writes us that the new works will include two 1,000,000-gallon pumps, about 8 miles of mains, 100 hydrants, and a 300,000-gallon stand-pipe, with a 70-ft. tower. The plans and estimates have not yet been completed, and the construction will depend upon the question of bonding the city. The population of the city is about 4,000, which is increased to 10,000 in the winter.

GURLEY, ALA.—It is reported that bids are now being received for the construction of water-works, estimated to cost $4,000. J. P. Joplin, Mayor.

LAFAYETTE, LA.—Bids are asked until Nov. 20 for surveys and estimates for a water and electric light plant. Address T. M. Blossat.

MARTIN'S FERRY O.—The contract for laying 4,000 ft. of 10-in. pipe, to connect with the Bridgeport mains, has been awarded to Cabel & Cauture, at $3,995. The other bids were: J. D. Stringer, $4,400; Hibberd & Sons, $4,370; Hallock & Hazlett, $4,115.

MOUNT STERLING, O.—Bids are asked until Nov. 12 for furnishing materials and constructing works, as described in our advertising columns Sept. 12. E. C. Cook, Engr., Cleveland; John W. Hanawalt, Cy. Clk.

OXFORD, O.—Bids are asked until Dec. 3 for constructing works. W. J. Rusk, Chairman; A. F. Sloane, Secy. Com.

CONNERSVILLE, IND.—The water-works committee is reported to have been authorized to secure plans and specifications for a 2,000,000-gallon pump.

EVANSVILLE, IND.—Local papers state that the bids for constructing a new well and intake have been rejected, and that the specifications will be changed and the work readvertised. This work was advertised in Engineering News, and the bids published in our issue of Oct. 24.

FORT WAYNE, IND.—We are informed that the following bids were received Oct. 26 for constructing an inlet well, as advertised in Engineering News:

Morton & Air, Newport, Ky.	$3,500
James W. Pearl, Benton Harbor, Mich.	5,280
H. W. Tapp, Fort Wayne, Ind.	5,650

LOGANSPORT, IND.—The water committee is reported as in favor of adopting the meter system, but is undecided as to the means of raising the necessary $20,000 for the purchase of meters.

MIDDLETOWN, IND.—Bids are asked until Dec. 4 for the purchase of $10,000 of 6% water bonds, and it is reported that bids for the construction of works will be received at the same time. J. O. Lambert, Pres. Bd.

SULLIVAN, IND.—Fred Hoke writes us that an election will be held Nov. 25 to vote on the question of constructing works; proposed supply from wells; population, 4,000.

CHARLOTTE, MICH.—It is reported probable that a special election will soon be held to vote on an issue of $18,000 in bonds for a new 5,000,000-gallon pumping engine and other improvements.

CORUNNA, MICH.—Wm. A. Knight, Cy. Clk., writes us that no engineer has yet been engaged to prepare plans for the water and electric light plant, for which $3,000 in bonds have been voted; population, 1,500.

SAGINAW, MICH.—The water board has prepared plans for a settling basin, 22 ft. wide and 50 ft. long, in the river opposite the pumping station and other work at the intakes.

WAYNE, MICH.—This village is reported to have appointed a committee to visit other places and investigate the question of water-works.

CHICAGO, ILL.—Bids are asked until Nov. 12 for laying water service pipes in St. Lawrence Ave., from

63d to 73d St. W. D. Kent, Comr. Pub. Wks.—The commissioner of public works is reported to have visited Louisville, Ky., last week investigating the question of filtration.

DANVILLE, ILL.—The water committee is considering plans for works, and it is reported that these will soon be submitted to a vote of the people.

JOLIET, ILL.—John W. Alvord and W. S. Shields, both of Chicago, have submitted a proposition to the council with a view to securing an additional water supply for the city.

NUNDA, ILL.—I. M. Mallory, Clk., writes us that water-works estimates and plans have been prepared, and that the city is ready to receive bids.

MARENGO, ILL.—The town board is reported to have voted to construct works, estimated to cost $25,000.

COLUMBUS, WIS.—A special election will be held Nov. 12 to vote on an issue of $25,000 in bonds for works.

COLUMBUS JUNCTION, IA.—The contract for constructing works has been awarded to the Smedley Mfg. Co., of Dubuque. The bids were published last week.

LAPORTE CITY, IA.—The contract for constructing works is reported to have been awarded to F. F. Vater & Co., of Minneapolis, and that for an electric light plant to the Fort Wayne Co. It is stated that the entire cost will be about $11,000.

SACRED HEART, MINN.—It is reported that bids are being received for sinking a 6-in. tubular well, and that if a water supply is secured, the construction of works will be voted upon next March.

SALINA, KAN.—The council is considering an ordinance providing for the purchase of works.

HASTINGS, NEB.—W. W. Miles, Cy. Clk., writes us that a new well, 300 ft. deep, is being sunk, and that Alexander E. Schnee, of New York, has been awarded a contract for a Pohle air-lift pump.

TALMAGE, NEB.—H. Bord, Clk., writes us that the contract for constructing works has been awarded to Honum & Ritter, of Talmage, at $8,175. Worthington pumping machinery and Adam's improved fire hydrants will be used.

ROCKY FORD, COLO.—At an election Oct. 24 the town voted to issue $3,000 in bonds for an additional artesian well.

HICO, TEX.—Daniel Pingree, mayor, writes us that plans will soon be prepared for works, for which the council recently voted; water supply from a well on top of a hill; estimated cost, $5,500 to $7,000. No engineer had been engaged at the time of writing, Oct. 28.

PALESTINE, TEX.—At a special meeting of the council Oct. 26 a resolution was passed notifying the water company that immediate steps must be taken toward a better water supply, or the city will resort to legal methods for guarding the health of the people, and may construct a municipal plant.

TEMPLE, TEX.—The water company is reported about to commence the construction of two brick and cement settling reservoirs for the purification of the Leon River water.

WACO, TEX.—The council has passed a resolution requiring the Bell Water Co. to erect another stand-pipe in the northern part of the city.

LAKEPORT, CAL.—It is reported that works will soon be constructed in this city. The water will be brought from Scott's Creek, some miles distant, by tunneling Califf Canyon.

NEVADA CITY, CAL.—A press report states that at the special election Oct. 28 the citizens voted to issue $60,000 in bonds for new works, as described in our issue of Oct. 10. Engr., Fred M. Miller, Grass Valley, Cal.

KALAMA, WASH.—A franchise for works has been granted to H. Orchard.

SEATTLE, WASH.—The council has passed a resolution providing for an election Dec. 10 to vote on an issue of $1,250,000 in bonds for a water supply from Cedar River.

IDAHO FALLS, IDAHO.—R. W. Faris is preparing plans for works at this place, to cost $35,000 to $40,000. If it is found that a gravity supply cannot be obtained, water will be pumped from the Snake River.

KENDRICK, IDAHO.—The citizens have voted to issue $10,000 in bonds for water-works, for which it is reported that plans will soon be prepared. Fred Breyerman, Cy. Clk.

IRRIGATION.

DENVER, COLO.—H. A. Sumner, State Engineer, Denver, informs us that the bids received Oct. 30 for sinking an artesian well near Holyoke were rejected, and the work will be readvertised. The bids are published under Contract Prices.

NEW COMPANIES.—Big Thompson Ditch Co., Denver, Colo.; $2,000; to operate in Northern Colorado; D. W. Miller, J. N. French, M. M. Osborn.

Weiser Reservoir, Land & Irrigation Co., Limited, Weiser, Idaho; $100,000; Henry M. Jarvis, James H. Holmes, John W. Ayers, Carey A. Tush.

Pierson Ditch Co., Visalia, Cal.; $32,220, with $26,850 paid in; to construct irrigation ditches, etc.; C. Hausch, John W. Stockes, Visalia; Timothy Hays, J. N. Halstead, Goshen, Cal.

Jefferson Water & Power Co., Jefferson, Colo.; to take water in pipe lines and ditches from Chicago and Echo lakes, South Beaver and Soda creeks, in Clear Creek county, for irrigating and for furnishing power, and also to acquire the property of the Mountain View Water Co.; $100,000; J. M. Walker, M. J. McNamara, E. F. Hallock.

SEWERAGE.

SOMERSWORTH, N. H.—The council proposes to construct 20 to 8-in. pipe sewers at an estimated cost of $13,591. Engr., F. S. Berry; A. A. Perkins, Chn. Com.

BROOKLINE, MASS.—Bids are asked by the selectmen until Nov. 11 for building a new channel for Smelt Brook and for building sewers. Engr., Alexis H. French, Brookline.

SALEM, MASS.—W. E. McClintock, of McClintock & Woodfall, Boston, has submitted a proposition for a sewage disposal plant for North Salem.

BRIDGEPORT, CONN.—The city surveyor has recommended the reconstruction of the Olive and Coleman St. system, estimated to cost $32,665.

PLAINVILLE, CONN.—A committee has been selected to report on the question of constructing a system. Enos S. Belden, Chn. Com.; Wm. W. Bullen, Town Clk.

WAREHOUSE POINT, CONN.—The Warehouse Point Village Improvement Association has been organized to urge the construction of sewers, etc. J. H. Simonds, James Price and C. G. Harrison are interested.

BUFFALO, N. Y.—The board of public works received the following bids Nov. 1 for constructing a sewer in Liberty Ave., from Kensington Ave. to Shawnee Ave.: F. J. Martin, $3,925; W. A. Rappich, $3,000; George O. Martin, $3,572; John Harrer, $2,594; Christopher Smith, $2,888; August Gisel, $2,150; Henry Harter, $2,598; Jacob Ritzman, $2,783; Mumm & Sell, $2,949; Elmer Mighton, $2,497, all bidders of Buffalo.

NEW YORK, N. Y.—Bids are asked until Nov. 13 for constructing sewers in five streets. Wm. Brookfield, Comr. Dept. Pub. Wks.

NIAGARA FALLS, N. Y.—The bids received Oct. 25 for the construction of a concrete sewer in 22d St., for draining the land and factories of the Niagara Falls Power Co., are still under consideration, and the contract has not yet been awarded. It is possible that the bids may all be rejected, and new bids asked. W. W. Read, Cy. Engr.—Michael Sandro, of Niagara Falls, has been awarded the contract for lowering the 15-in. pipe sewer in Main St. through 1,000 ft. of rock, at $2,528.

SYRACUSE, N. Y.—Bids are asked until Nov. 11 for constructing a 40 × 60-in. brick and a 15-in. pipe sewer. H. F. Stephens, Cy. Clk.

WESTPORT, N. Y.—A town meeting has been held to vote on the question of constructing a system, plans for which have been prepared, according to reports.

CRANFORD, N. J.—Carroll Ph. Bassett, of Summit, N. J., has been directed by the township committee to prepare specifications for 25,800 ft. of lateral sewers, estimated to cost $18,500.

PERTH AMBOY, N. J.—The aldermen have voted to construct 36 × 24-in. brick sewers in two streets, according to reports.

SEA ISLE CITY, N. J.—It is stated that the Sea Isle City Electric Light, Power & Water Co. has decided to receive bids for constructing a water-works and sewerage system in this city.

WOODBURY, N. J.—D. F. Mather, Cy. Clk., writes us that nothing has been done in regard to sewers since the plans were prepared, and it is not likely that any work will be done soon.

ALTOONA, PA.—We are informed that Noyes & Hazen, 85 Water St., Boston, Mass., are making examinations and estimates for purifying the sewage from the southern part of the city, in connection with the new outfall sewers now in course of construction. Harvey Linton, Cy. Engr.

ELIZABETH, PA.—G. W. Deemer, Borough Clk., writes us that Robt. Their, of McKeesport, Pa., has been awarded the contract for constructing 10,454 ft. of 18 to 12-in. pipe sewers at about $9,000. C. M. Clay, Borough Engr., Elizabeth.

NORWOOD, PA.—Bids are asked until Nov. 28 for constructing a system of sewers as stated in our advertising columns. C. N. Walters, Chn. Com., Norwood; Engr., R. M. Harris, Jr., Collingdale, Pa.

CANTON, O.—An election was held Nov. 5 to vote on the question of issuing $57,000 in bonds for constructing a 78-in. brick sewer one mile long for Shriver's Run. L. E. Chapin, Cy. Engr.

CLEVELAND, O.—M. E. Rawson, Ch. Engr., writes us that a sewer is in contemplation from Walworth Run to provide for a large drainage area. Walworth St. has been opened up the valley, and it is likely that the sewer will follow this street when built. No working plans have yet been prepared.

EVANSVILLE, IND.—Bids are asked by the board of public works until Nov. 26 for constructing a main sewer in Garvin St. Elmer E. Clarke, Clk.

FORT WAYNE, IND.—The city engineer has submitted plans for a main sewer in Bloomingdale.

ST. CLOUD, MINN.—The council is again considering the question of constructing a system.

SAN FRANCISCO, CAL.—Property owners of the southeast mission are discussing the question of constructing brick sewers in several streets. A. P. Van Duzer is interested.

HAMILTON, ONT.—E. Kuichling, Rochester, N. Y., writes us that the outlet sewer, sewage pumping plant, etc., recently suggested by him for this city will probably not be built for some years, as the project embraces more work than is now deemed necessary. A part of the general plan may be undertaken next year, but Wm. Haskins, Cy. Engr., Hamilton, writes us that no arrangements have yet been made for any appropriations to carry out the work.

GARBAGE DISPOSAL.

PATERSON, N. J.—The mayor has refused to sign the contract recently awarded by the aldermen to the Paterson Sanitary Co., stating that the charge is too high. It is stated that the company was to receive $25,000 for taking care of the garbage until next April, and $30,000 a year for the next five years.

PARKERSBURG, W. VA.—Bids are asked until Nov. 11 for the removal of garbage, ashes, etc., for one year, commencing Jan. 1. W. H. Ogdin, Cy. Clk.

CHARLOTTE, N. C.—We are informed that the city authorities are considering the question of purchasing a garbage crematory.

CLEVELAND, O.—H. L. Payne and L. K. Shinners are reported as interested in a scheme to construct four garbage crematories, at a cost of about $40,000 each.

COLUMBUS, O.—Bids are asked until Nov. 15 for the construction of a garbage crematory at Columbus Barracks, according to reports. Capt. E. S. Dudley, Asst. Q. M.—Local papers state that the following bids were received Oct. 26 for garbage removal: Thos. Ross, $23,900 a year for 10 years; G. & C. Geigele, $16,000 a year for 100,000 people, and 16 cts. per capita for each addition to this number, or a lump bid of $3.50 a ton a year; Columbus Melting Co., $168,000 for 10 years, being $13,000 for the first year, and increasing to $20,000 for the last year.

EVANSVILLE, IND.—Elmer E. Clarke, Clk. Dept. Pub. Wks., writes us that the following bids were received Oct. 26 for constructing a garbage crematory, the awarding of the contract being postponed until Nov. 16:

Engle Sanitary & Cremation Co., Des Moines, Ia.	$9,000
Dixon Sanitary Garbage Cremation Co., Findlay, O.	9,450
A. Brownlee, Dallas, Tex.	10,000

ST. PAUL, MINN.—The joint committee on garbage of the council has recommended that the city construct crematories and burn the garbage.

STREETS AND ROADS.

BROOKLYN, N. Y.—Bids are asked until Nov. 15 for asphalt paving in nine streets; sureties, $1,000 to $16,500. Alfred T. White, Comr. Cy. Wks.

CINCINNATI, O.—Bids are asked until Nov. 11 for improving several streets in Village Hill. Engr., F. Layman, 32 East Third St., Cincinnati; F. R. Stee[illegible], Village Clk.

NEW YORK, N. Y.—Bids are asked by the department of public parks, Arsenal, Central Park, until Nov. 13, for the construction of Riverside Park, between 70th and 96th Sts., the work to include the following: 4,000 cu. yds. earth excavation, 200 cu. yds. rock excavation, 19,000 cu. yds. of filling to be furnished in place, 28,000 cu. yds. of mold or top soil furnished in place, 5,500 lin. ft. of bluestone steps for walks, 1,200 lin. ft. of bluestone cheek pieces, 118 walk basins, 2 ft. 6 ins. interior diameter, with cast iron curb and grating; 16 surface basins, 3 ft. 6 ins. interior diameter, with cast iron curb and grating; 3,460 lin. ft. of 6-in. stoneware pipe, 2,710 lin. ft. of 8-in. stoneware pipe, 3,160 lin. ft. of 12-in. stoneware pipe, 750 cu. yds. rubble-stone masonry in cement mortar, in foundation walls; 20 cu. yds. concrete in place, 310,000 sq. ft. sod, 10 acres of ground to be finished and seeded, 91,800 sq. ft. walk pavement of asphalt with concrete base, including rubble-stone foundation; 59,700 sq. ft. of walk pavement of asphalt with concrete base, on existing stone foundation—laid or partly laid. The security required is $80,000, and the work must be completed by June. And until the same date by the park department for 46,100 sq. ft. of asphalt sidewalk on a base prepared by the department.—Bids are asked until Nov. 13 for paving with asphalt Malden Lane from Broadway to Pearl St. Wm. Brookfield, Comr. Pub. Wks.

NIAGARA FALLS, N. Y.—The council proposes to pave 10,300 sq. yds. in Ontario Ave. with asphalt, and 9,200 sq. yds. in Main St. with asphalt at a cost of about $60,000, bids for which will probably be asked within 30 days. W. W. Read, Cy. Engr.; S. F. Arkush, Cy. Clk.

NARBERTH, PA.—The council has passed an ordinance for macadamizing 10 streets, bids for which will soon be asked. A. B. Redifer, Clk. Council; A. H. Mueller, Ch. Burgess.

NEW CASTLE, PA.—The council has been recommended by the finance committee to issue $40,000 in bonds for street improvements.

PHILADELPHIA, PA.—Arrangements are being made for repaving a number of streets, at an estimated cost of $500,000. Bids are to be asked for the work as soon as the streets to be paved are selected. Thos. M. Thompson, Dir. Pub. Wks.

CINCINNATI, O.—Bids are asked by the board of administration until Dec. 2 for paving portions of two streets with brick.

LAFAYETTE, IND.—W. K. Eldridge, Cy. Engr., informs us that the following bids were received Oct. 28 for brick paving in Sixth St., all the bidders being residents of Lafayette: John D. Richardson (awarded contract), $4 per front ft.; James Parlon, $4.15; Wm. F. Frey, $4.50.

ALTON, ILL.—It is stated that bids will soon be asked for 35,000 ft. of macadamizing. E. E. Rutledge, Cy. Engr.

WAUKEGAN, ILL.—The following bids have been received for macadamizing about two miles of State St.; Engr., H. W. Large, of Waukegan: McCarren, Detroit, Mich. (informal), $31,849; C. E. Loss, Chicago (awarded contract), $32,764; James Bairstow, Chicago, $34,232; J. Lyman, $34,387; Dolese & Shepard, $43,781. The engineer's estimate for the paving was $36,041.

MANUFACTURING PLANTS.

PORTLAND, ME.—A report states that A. T. Brackett is preparing to erect a mill, 50 × 100 ft., on Hanover St.

WATERVILLE, ME.—The Hollingsworth & Whitney Co. has commenced work on the foundations for a new machine shop, to be built of brick and wood, 90 × 118 ft.

HOLYOKE, MASS.—It is stated that the Labelle Mfg. Co. will be organized within a few days, and that work on the factory will be commenced before Jan. 1.

LEOMINSTER, MASS.—A. E. Lyon has the contract for building the Richardson piano factory, and will begin work at an early date.

NEW BEDFORD, MASS.—Press reports state that John F. Strange has received a patent on twist drills, and will form a company in New Bedford for their manufacture, with a capital stock of $75,000.

WORCESTER, MASS.—The board of trade is said to be trying to secure the location of the Waltham Clock Co.'s plant.

NEW BRITAIN, CONN.—The H. Wales Lines Co., of Meriden, Conn., has been awarded the contract to build a brick mill, 139 × 51 ft., for the Stanley Co.

HOOSICK FALLS, N. Y.—A report states that the Miller, Hall & Hartwell Collar Co., of Troy, N. Y., will build a factory here, 120 × 60 ft., two stories high.

EAST SETAUKET (L. I.), N. Y.—It is reported that the East Setauket Rubber Co. will enlarge its plant at once, by the erection of two buildings at Setauket, 48 × 80 ft. and 20 × 60 ft., three stories high, and equipped with the most modern machinery.

ALLENTOWN, PA.—Three representatives of a large woolen manufactory have been in Allentown seeking a site, with the view to locating a branch plant. A committee of the board of trade, composed of W. K. Ruhe, Charles H. Edwards and others, showed the party available sites. It is proposed to erect a building 1,000 × 400 ft.

BEAVER FALLS, PA.—The Keystone Axle Co., of Baltimore, Md., has closed negotiations for a site at Beaver Falls for its works.

BEAVER FALLS, PA.—Reports state that a deal has been consummated whereby the Keystone Axle Co., composed of capitalists of Baltimore, will locate a

plant near this city. The company will manufacture car and other axles, and will erect a plant 80 × 200 ft., work on which will commence shortly. Pres., D. C. Clark.

BLOOMSBURG, PA.—Hartman & Hassart, manufacturers of mine cars, castings and wrought iron work, are preparing to erect an addition to their plant.

PITTSBURG, PA.—At a recent meeting of the stockholders of the Frank-Kneeland Machine Co., rolling mill machinery and roll manufacturers, a resolution was passed empowering the officers to extend the machine shop building from its present terminus to the Allegheny Valley R. R., a distance of 160 × 100 ft.; this, with the additional equipment of machinery of an 8-ft. planer, 16-ft. boring mill, 10-ft. horizontal boring mill, three roll-turning lathes, a 20-ton electric traveling crane, additional boiler, engine and generating capacity, and such other tools as will be necessary to make the plant complete in every detail, will about treble its present capacity. An addition of 50 × 100 ft. has just been added to the foundry, and a third air furnace will be added.

SHAMOKIN, PA.—The board of trade has accepted the proposition of the Bethlehem Silk Mill Co., and an effort will be made to erect a building to cost $30,000. George W. Ryan is interested. The Bethlehem company agrees to equip the mill with $70,000 worth of machinery.

VERSAILLES, PA.—At a meeting of the borough council, recently held, the proposition of the Versailles Land Co., the members of which are composed of stockholders of the National Galvanizing Works, and who agree to locate a plant here, provided it be exempt from payment of taxes for a period of 10 years, was accepted. The proposed site of the new plant is along the Youghiogheny River, and about 200 men will be given employment.

BALTIMORE, MD.—It is reported that preparations for the establishment of a large gun factory at Baltimore are being made. Address Ansley H. Fox, 1205 West Fayette St.

WINCHESTER, VA.—It is understood that the Lewis Jones Knitting Co. will add 150 new machines to its plant.

RALEIGH, N. C.—A new cotton mill is to be built and equipped as a weave mill five miles north of this place. W. V. Clifton has the contract to build a dam and long bridge, but the contracts for buildings and machinery have not yet been awarded.——The Caraleigh cotton mills will purchase several thousand dollars worth of new machinery, to repair damages by a recent accident to the engines and other machinery.

ANNISTON, ALA.—A company, with Wm. J. Stevens as president, has been chartered to build a cotton mill to cost $100,000 at this place, to try the experiment of operating a cotton mill with negro operatives. All the members of the company are negroes.

DOUGLASVILLE, GA.—Press reports state that the Eden Park Cotton Mills will increase its capacity 1,500 spindles before Dec. 15.

THOMASVILLE, GA.—It is reported that the Southern Hosiery Co. intends to organize a new company to enlarge its mill and put in additional machinery. W. C. Snodgrass and others are interested.

CHATTANOOGA, TENN.—The Casey & Hedges Mfg. Co. has had plans prepared for its new shops. A foundry will also be added.

CLEVELAND, O.—A report states that the plant of the Duplex Typewriter Co. will be removed from Des Moines to Cleveland.

CLEVELAND, O.—A report states that the Ajax Mfg. Co. will begin the erection of a brick and steel building 120 × 40 ft., two stories high, on Hamilton St. and Case Ave., within the next month. Bolt headers, upsetters and forging machinery are manufactured by the company.

CUYAHOGA FALLS, O.—The works of the Falls Rivet & Machine Co. were partially destroyed by fire recently. Reported loss, about $35,000.

ANDERSON, IND.—A company of Chicago capitalists has signed contracts to locate a steel plant in this city, according to a press report, in consideration of a $50,000 bonus and a free gas fuel franchise; and will begin work at once putting in the plant. It is to employ 500 men before the bonus is paid.

KALAMAZOO, MICH.—Report states that the Bryant Paper Co. will locate in this city, and will at once commence the erection of a brick building 500 × 70 ft., and a storehouse 200 ft. in length. One large paper machine will be used at first, and others will be added as needed. Three engines will be purchased, one of 500 HP., one of 100 HP. and another of 75 HP.

CHICAGO, ILL.—It is reported that N. K. Fairbank & Co., 58 Wabash Ave., will erect a two-story and basement addition, 46 × 100 ft., of brick and stone, to the factory at 215 18th St., to cost $12,000. Arch., J. C. Llewellyn, 66 Adams St.——Press reports state that Wertz & Thiel, 571 Ashland Ave., will erect a two-story wagon factory of brick and stone, on Ashland Ave., near 13th St., to cost $15,000. Arch., M. Mueller, 234 West 13th St.

MOUNT CARMEL, ILL.—The Standard Machine Works were recently burned; reported loss, $50,000.

NEENAH, WIS.—It is understood that Kimberly, Clark & Co. have secured an option on 500 acres of land at Quinnesec Falls on the Menominee River, including an extensive water power, for erecting a large paper and pulp mill.

FORT MADISON, IA.—Efforts are being made to form a company here to manufacture shears, the patent being held by Mr. Ell, of St. Louis, who is actively interested in locating the industry here.

DULUTH MINN.—A press report states that the Upper Peninsula Brewing Co. has purchased a site, and will commence the erection of a brewery at once. The brewery will have a capacity of 50,000 bbls., and a malthouse with a capacity of 250,000 bushels.

ST. LOUIS, MO.—It is stated that a four-story building will be erected south of Prospect Heights, on the river front, at an early date, to be of brick and stone, 120 × 200 ft., and to cost $150,000. The building will be occupied by a wire brush company of Indianapolis, which will begin operations in April.

AUSTIN, TEX.—It is stated that $10,000 for a proposed $60,000 cotton mill at this place has been raised, and the work on the building will soon be begun.

SPOKANE, WASH.—C. W. Hoefer and H. Hoefer, of New Ulm, Minn., have made a proposition to the trades council of this city, whereby they agree to erect a mill to cost $15,000 to $16,000, provided the citizens will take $5,000 to $6,000 worth of stock.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

CAR FENDERS.—Providence, R. I.—The Union R. R. Co. has been directed to equip its cars with fenders within six months.

DRAINAGE.—Macon, Ga.—A bill has been introduced in the legislature authorizing the county commissioners to drain the swamp adjacent to this city.

DREDGING.—Mobile, Ala.—Z. M. P. Inge has petitioned for authority to do $10,000 worth of dredging between the foot of St. Francis St. and the channel.

FIRE ALARM SYSTEM.—New Orleans, La.—Our correspondent writes us that the council is considering an ordinance providing for a new fire alarm system in this city. L. W. Brown, Cy. Engr.

ANCHORS.—Washington, D. C.—Bids are asked until Nov. 12 for a quantity of wrought iron and cast steel anchors for the League Island navy yard. Edwin Stewart, Paymaster General, U. S. N.

COAL.—Washington, D. C.—Bids are asked until Nov. 12 for 3,000 tons of bituminous coal for the naval station at Key West, as stated in our advertising columns. Edwin Stewart, Paymaster General, U. S. N.

STONE CRUSHER.—Plainville, Conn.—A press report states that the stone crusher erected about a year ago by James H. Cook, near the New Britain town line in Plainville, has been entirely destroyed by fire; reported loss, $12,000; insurance, $2,000.

SALE OF OLD MATERIAL.—Washington, D. C.—There will be sold at the naval proving ground, Indian Head, Md., Nov. 15, a quantity of old Harveyized nickel steel, etc., as stated in our advertising columns. W. McAdoo, Acting Secy. of Navy.

OCEAN PIER.—Old Orchard, Me.—The Old Orchard Ocean Pier Co. has petitioned for a charter; Pres., Henry W. Staples; Secy., E. M. Yates; Treas., F. G. Staples. It is proposed to issue bonds and have the pier constructed before the next summer season opens.

GAS PLANT.—Mount Clemens, Mich.—A 30-year gas franchise has been granted to W. S. Parker, Frank Hale, Jos. Holman and others, and it is stated that the new plant will be in operation by July 1. For the first five years $1.30 per M. cu. ft. will be charged. The city will fix the rates every five years.

CANAL.—Seattle, Wash.—The secretary of war has approved the surveys made by Eugene Ricksecker for the north canal. About $20,000 remains of a government appropriation for this work, and the county commissioners will levy a tax for the right of way. Roger S. Greene, Thos. Burke and J. J. McGilora are among those interested.

COMPOSITE GUNBOATS.—Washington, D. C.—The secretary of war awarded the following contracts Nov. 2 for the six composite gunboats authorized by last Congress: Two of the vessels, the twin screw, will be built by the Union Iron Works, San Francisco; one by Dialogue & Sons, of Camden, N. J.; one by Louis Nixon (the Crescent Shipbuilding Co.), Elizabethport, N. J., and two by the Bath Iron Works, Bath, Me.

STATE CANAL WORK.—Albany, N. Y.—The following contracts were awarded by Geo. W. Aldridge, Supt. Pub. Wks., Oct. 31: For removal of sidewalks on State St. bridge over the canal at Schenectady, to the Rochester Bridge & Iron Works, at $1,705; for extending the dyke protecting property adjacent to the Chemung River in the town of Corning, to R. E. Beardsley, of Elmira, at $5,348; for dredging the Lower Black Rock Harbor, Buffalo, to Hingston & Woods, of Buffalo, at $2,610.

CONTRACT PRICES.

STEEL STRUCTURAL WORK.—Boston, Mass.—The contract for the structural steelwork for the third section of the subway has been awarded to the Pennsylvania Steel Co., at a reported price of $49.88 a ton.

BASALT BLOCK PAVING.—San Francisco, Cal.—The contract for paving portions of several streets with basalt blocks has been awarded to M. F. Sullivan, at 17 cts. a sq. ft. for paving, and 73 cts. a lin. ft. for granite curbing. John A. Russell, Clk. Supervisors.

LAYING WATER PIPE.—Lorain, O.—F. C. Norcross, Supt., writes us that the following bids were received Oct. 29 for laying water pipe: John Stang, Lorain, $4,800; Standard Construction Co., Lorain, $5,500; Alex. McGee, Lorain, 18 cts. a ft. for 6-in. and 40 cts. for 12-in. pipe.

SEWERS.—San Francisco, Cal.—The supervisors have awarded the contract for a pipe sewer to D. O'Connor, at the following prices: 12 and 8-in., ironstone pipe sewer, 67 cts. a lin. ft.; manholes and covers, $33 each; corners, complete, $87; corners, granite curbs only, $27 each. Jno. A. Russell, Clk.

ARTESIAN WELL.—Denver, Colo.—H. A. Sumner, State Engr., writes us that the bids received Oct. 30 for sinking an artesian well near Holyoke have been rejected, and the work will be readvertised. The bids were as follows: Grossmayer & Hobart, Denver, 4-in. well, 1,200 ft. deep, $4,500, and $3.50 for each additional foot; 6-in. well, 1,100 ft. deep, $4,500, and $3.75 for each additional foot; J. T. McCarthy, Minneapolis, Minn., for a 4, 6 or 8-in. well, 643 ft. deep, $4,500, and $8 for each additional foot.

ASPHALT PAVING.—New York, N. Y.—The contracts for paving portions of two streets with asphalt have been awarded to the California Asphalt Co., 50 East 59th St., New York, at $3.05 a sq. yd. for paving, and 60 cts. a lin. ft. for new curbing. The Barber Asphalt Paving Co., 1 Broadway, New York, bid $3.57 and 48 cts., respectively; Fruin-Bambrick Construction Co., 35 Broadway, New York, $3.14 and 50 cts.; Sicilian Asphalt Co., 38 Hillside Ave., Montclair, N. J., $3.45 and 50 cts.; Warren-Scharf Asphalt Paving Co., 81 Fulton St., New York, $3.28 and 50 cts.

ARTESIAN WELLS.—Lebanon, Pa.—A contract for sinking one or more 6-in. wells, from 50 to 250 ft. deep, has been awarded to Samuel MacEachne, Man. National Boring & Drilling Co., of Scranton, Pa., at $2.25 a ft., except where a black band or traprock is struck, when will be $6 a ft.; contractor to furnish everything. An offer was made by Mr. MacEachne to sink an 8-in. well, 800 ft. deep, at $4 a ft., except for traprock, which will be $8, or $1 an inch diameter, but it is probable that this will not be accepted until the results of the smaller wells are ascertained. Geo. W. Hayes, Cy. Engr.

BRIDGE ABUTMENTS.—Indianapolis, Ind.—The following bids were received for masonry abutments for Meridian St. bridge over Pleasant Run: Delaney & Dawson, Cincinnati, dry excavation, 15 cts. a cu. yd.; wet excavation, 90½ cts. a cu. yd.; masonry, $6.78 a cu. yd.; coping, 75 cts. a cu. ft.; timber in foundation, $24 a M. ft. Koss & Fritz, Indianapolis, 25 cts., 50 cts., $7.25, 50 cts., $18, respectively, using stratified limestone. They offered also $10 a cu. yd. for oolitic limestone masonry and 75 cts. a cu. ft. for oolitic coping. Hege & Sebern, Indianapolis, 25 cts., $1, $7.20, blank, $21, respectively. The contract was let to Koss & Fritz, as the lowest bidders on the whole.

ASPHALT PAVING AND SEWERS.—Indianapolis, Ind.—New bids were received Oct. 26 for asphalting Ash St., as described in our issue of Oct. 17, as follows: Western Paving & Supply Co., $4.66 a lin. ft. of each side of the street; Indiana Bermudez Co., $4.63; Warren-Scharf Asphalt Paving Co., $4.52. All bids were rejected, and all action on the resolution was rescinded. Bids were not opened for the asphalting of Alabama St., and action on these resolutions was rescinded. Action was also rescinded on resolution for paving Kentucky Ave. with brick, for paving sidewalks of First St. with cement, and for 8,092 ft. of 75 to 32-in. brick sewer in Capitol Ave. The bids on this latter work were as follows: Hege & Sebern, $5.35 a lin. ft.; W. Bossert, $5.27; M. M. Defrees, $4.97; Sheehan Bros., $4.83; Gansberg & Roney, $4.78; Capitol Paving & Construction Co., $4.64; W. R. Mercer & Co., $4.47, and Browder & Shover, $4.45. The address of all bidders is Indianapolis. Our correspondent writes us that a new board of public works has recently been appointed by the new mayor, and does not seem disposed to continue the system of improvements laid out by the former board.

METAL MARKET PRICES.

LEAD.—New York: 3.3 to 3.33 cts. Chicago: 3.15 to 3.17 cts. St. Louis: 3 to 3.1 cts.

BARB WIRE.—Pittsburg: $2.70 and $2.80 for galvanized, and $2.30 and $2.40 for painted in carload and less than carload lots at mill.

FOUNDRY AND PIG IRON.—New York: $12.50 to $14.50. Pittsburg: $12.75 to $15. Chicago: $13 to $15.50.

TRACK MATERIAL.—New York: angle bars, 1.45 to 1.5 cts.; spikes, 1.8 to 1.85 cts.; track bolts, 2.15 to 2.25 cts. with square, and 2.25 to 2.4 cts. with hexagon nuts. Chicago: angle bars, 1.65 to 1.8 cts.; spikes, 1.9 to 2 cts.; track bolts, 2.25 to 2.35 cts. with square and 2.5 to 2.6 cts. with hexagon nuts.

NAILS.—Pittsburg: $2.25 per keg for carload lots and $2.52 for wire nails, $2.17 and $2.25 for cut nails, mill; $2 and $2.05 for cut nails at mill. Chicago: $2.42 and $2.52 for wire nails, $2.43 and $2.53 for cut nails. New York: $2.43 and $2.53 for wire nails, and $2.18 and $2.26 for cut nails.

RAILS.—New York: $28 at eastern mills and $28.75 at tidewater; old rails, $15 to $16 for iron, and $13 to $13.50 for steel; light rails, $29; girder rails, $26. Pittsburg: $28 for standard sections of 45 lbs. and over; $28 for light sections; old rails, $19.75 for iron and $17 for steel. Chicago: $29 to $31 for standard sections; $28 for light sections; old rails, $18 for iron, and $13.50 to $15 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.75 to 2.1 cts.; channels, 1.85 to 2 cts.; angles, 1.65 to 1.8 cts.; tees, 1.9 to 2 cts.; universal mill plates, 1.75 to 1.95 cts.; steel plates, 1.75 to 2 cts. for tank, 2 to 2.1 cts. for shell, 2.1 to 2.25 cts. for flange, 2.4 to 2.5 cts. for ordinary firebox, 2.6 to 2.75 for locomotive firebox. Pittsburg: beams, 1.6 to 1.9 cts.; channels, 1.6 to 1.9 cts.; angles, 1.5 to 1.6 cts.; tees, 1.6 to 1.65 cts.; Z-bars, 1.6 to 1.65 cts.; universal mill plates, 1.8 to 1.9 cts.; steel plates, 1.7 to 1.75 cts. for tank, 1.8 to 1.85 cts. for shell, 1.9 to 1.95 cts. for flange, 2.5 cts. for ordinary firebox, 2.5 to 4 cts. for locomotive firebox. Chicago: beams, 1.8 to 1.9 cts.; channels, 1.8 to 1.9 cts.; anvles, 1.75 to 1.85 cts.; tees, 1.95 to 2 cts.; universal mill plates, 1.95 to 2.05 cts.; steel plates, 1.95 to 2.05 cts. for tank, 2.25 to 2.35 cts. for flange, 2.8 to 2.9 cts. for ordinary firebox, 4 to 4.5 cts. for locomotive firebox.

IRON AND STEEL.—The New York "Journal of Commerce" states that foundrymen are placing few and only small orders in this market. The large concerns are apparently in comfortable position, having liberal supplies under contract, and still move very conservatively in anticipating their probable wants during the early part of next year. There is more iron on sale at present than for some time past, and it appears also that deliveries on existing contracts are being deferred to a moderate extent, at buyers' request. Sellers' prices are unchanged, but the undertone of the market is not better than barely steady. In foreign material there is very little doing at the moment, and few, if any, new inquiries for important quantities have come upon the market recently. Old rails and wrought scrap iron are in better demand. Only moderate-sized lots are asked for, however, and the prices bid are considerably below sellers' ideas as a rule. Burnt iron is selling better, and prices are firmer, with $6.50 the inside. Other old material remains quiet, and is without change in price. Steel rails remain quiet. Few inquiries are on the market for either heavy or light sections. Manufacturers are well employed on old contracts, however, and hold firmly at old prices. Other heavy finished products are steady, as also ordinary merchant steel and iron, but business is only fair.

INDUSTRIAL NOTES.

THE JONES BRICK CO., of Knoxville, Tenn., has a new patented paving brick on the market.

THE FINISHED STEEL CO., of Youngstown, O., has started fires under the boilers of its new plant.

THE CHATEAUGAY ORE & IRON CO., of Standish, Clinton county, N. Y., is building a new, seven-fire, catalan forge.

THE Q. & C. CO., of Chicago, Ill., reports a very brisk business, especially in its metal-sawing machine department.

THE PENNSYLVANIA STEEL CO., of Steelton, Pa., has an order for 25 miles of girder rails for the Washington, Alexandria & Mt. Vernon R. R.

THE CENTRAL BRIDGE & ENGINEERING CO., of Peterborough, Ont., has been awarded the contract for building a 60-ft. steel bridge at Glencolin.

THE NEW YORK DREDGING CO., of New York, N. Y., has the contract for building the terminal piers of the Southern Railway Co. at Norfolk, Va.

THE BETHLEHEM IRON CO., of Bethlehem, Pa., has contracted with the navy department for 27 forgings for 4-in. guns and 13 forgings for 5-in. guns.

THE SAYRE METAL WORKS, of Waverly, N. Y., is enlarging its plant by the erection of an addition to the main building, and the capital stock will be increased to $100,000.

HYDE BROS., of Pittsburg, Pa., recently received a contract from Moorhead Bros, & Co., of Sharpsburg, for a 200-HP. boiler, to be used in connection with the heating furnaces.

THE PLAYFORD STOKER CO., 919 Society for Savings Bldg., Cleveland, O., recently equipped a set of boilers in the city water-works pumping station with automatic stokers.

THE LEWIS FOUNDRY & MACHINE CO., of Pittsburg, Pa., recently shipped two sheet mills to the Midland Steel Co., of Muncie, Ind., and one to the Reeves Iron Co., of Canal Dover, O.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has completed an iron building 70 × 120 ft. over the stone yard of Jas. McLaren, Brooklyn, N. Y. The building is arranged to carry a 15-ton traveling crane.

THE LACONIA CAR CO., of Laconia, N. H., lost by fire last week its large shop, used for setting up freight cars and trucks. Reported loss of about $50,000, which is covered by insurance. Rebuilding will commence at once.

THE AMERICAN WATER-WORKS CO., of Omaha, Neb., has ordered from the South Pittsburg Pipe Works 5,000 tons of pipe for laying the 30-in. main to South Omaha and extending its distribution system in Omaha.

THE BROWN HOISTING & CONVEYING MACHINE CO., of Cleveland, O., through its Chicago office, has recently sold to the Le Wolff Mfg. Co., of Chicago, a 3-ton hand power traveling crane of the pendent winch type, for foundry use.

ISAAC M. KEITH, of Sagamore, Mass., has received a contract from the New York, New Haven & Hartford R. R. for 300 flat cars. Mr. Keith has sub-let the ironwork to Mr. Nye, of Bournedale, Mass., which will call for about 400 tons.

THE LODGE & DAVIS MACHINE TOOL CO., of Cincinnati, O., continues to increase its export trade, having recently shipped eight machines to England, two to Russia, three to South America and two carloads to one party in Chihuahua, Mexico.

THE CLONBROCK STEAM BOILER CO., of Brooklyn, N. Y., recently installed an 800-HP. boiler for the Candee Rubber Co., of New Haven, Conn. The boiler is 36 ft. high, 15 ft. in diameter, and has 720 tubes. A steel stack 100 ft. high furnishes draft.

THE RICHARDSON, BOYNTON & CO.'S works at Dover, N. J., are being rapidly pushed to completion. In addition to the $95,000 contracts for buildings already awarded, others, amounting to $27,000, have been concluded for machinery, boilers, electric plant, etc.

THE SNOW-WATSON CO., of West Superior, Wis., which was recently formed, will manufacture, sell and act as manufacturers' agents for the sale of boilers, engines, pumps, pulleys, belting, shafting and mill and factory supplies. Address J. F. Fawcett or W. J. Allen.

R. L. WALKER, 104 Fifth Ave., Pittsburg, Pa., patentee of the Walker smoke-preventing and fuel-saving furnace, has received contracts to put furnaces on all the boilers of the Spang Steel & Iron Co.'s plant at Etna, Pa., and the National Tube Works Co., McKeesport, Pa.

THE HUNTINGDON CAR & WHEEL WORKS, of Huntingdon, Pa., which has been idle for three years past, was purchased recently by W. A. Obyon, of Savannah, Ga., for a syndicate of Southern capitalists, and will soon commence the manufacture of trolley cars.

THE PITTSBURG REDUCTION CO., of Pittsburg, Pa., has established a store in Chicago, with A. K. Lawrie in charge, and one in New York city, with B. O. Bakewell in charge. At the Chicago store a stock of aluminum in the form of ingots, sheet, wire, rod, tubes and castings for retail demands will be carried.

THE AMERICAN WELL WORKS, of Aurora, Ill., is erecting an iron foundry at its works in Aurora, Ill. The company will use all the latest appliances, employing a pneumatic system for lifting the flask and drawing patterns and the general hoisting around about the foundry. Parties having latest appliances are asked to correspond.

THE NORWICH BELTING CO., of Norwich, Conn., is running full time, and several large orders have been placed, including one to furnish belting for the Berkshire Cotton Mill, No. 3, of North Adams, Mass., which calls for 60,000 ft. of belting, and is said to be the largest order ever placed with a New England belt manufacturer.

THE BATH IRON WORKS, of Bath, Me., is said to have under consideration the subject of changing the motive power of its plant by substituting electricity for steam. Should the change be made, a small low-pressure boiler will be used for heating purposes, and a large number of incandescent lamps and perhaps several arc lamps would be added.

CHAS. A. SCHIEREN & CO., of New York, Boston, Philadelphia and Chicago, have received an order for 3,200 ft. of leather belting for the complete equipment of a cotton mill in Mexico; also an order for 3,500 ft. of leather belting to go to South Africa, besides a complete equipment of perforated dynamo belts for an electric street railway to be constructed in Africa.

THE ABBOTT-GAMBLE CONTRACTING CO., 620 Chestnut St., St. Louis, Mo., has the contract for putting down 9,000 sq. yds. of brick paving at Belleville, Ill.; the Wabash Clay Co., Veedersburgh, Ind., is to furnish the brick; the company also has the contract for putting in some heavy foundations for the new dynamos for the Missouri Electric Co., St. Louis; A. A. Wagner, Supt.

BEMENT, MILES & CO., of Philadelphia, Pa., have recently shipped a lathe to San Francisco, with a 10½-ft. swing and four independent carriages, which turns 50 ft. long and weighs 350,000 lbs. Another shipment was to Buda-Pesth, to the government railway shops, consisting of a boring mill, planer, and a large milling machine; and to Berlin one slotting machine, with 54-in. stroke.

THE LLOYD BOOTH CO., of Youngstown, O., recently shipped the Illinois Steel Co., Joliet, Ill., one each 10-in., 11-in. and 14-in. improved Garrett rod trains, three roll lathes, and two lever shears; the Sylvan Steel Co., Moline, Ill., one plate mill; the Union Iron & Steel Co., Youngstown, lever shears and roll lathe; the Finished Steel Co., Youngstown, O., special machinery for its new plant.

THE H. C. FRICK COKE CO., of Pittsburg, Pa., has purchased the entire plant and franchises of the McClure Coke Co., and has removed the office of the company to the Carnegie Bldg., where for a time it will continue to run as a separate organization. This, with the recent purchase of the Fairchance Furnace Co.'s plant, gives the Frick company control of over 12,000 ovens in the Connellsville region out of a total of about 17,000 ovens.

THE ATLAS CEMENT CO., of New York, N. Y., is building one of the largest and best-equipped cement mills in this country near Allentown, Pa., where it owns a large area containing an excellent quality of cement rock. The mill buildings will cover an area of 700 sq. ft., and consist of the kiln structure, 123 × 221 ft.; engine house, 106 × 104 ft.; pulverizing building 177 × 58 ft.; rock storage building, 80 × 90 ft.; stock house, 100 × 400 ft., and boiler house, 100 × 125 ft.

THE DOWN-DRAFT FURNACE CO., of St. Louis, Mo., has appointed W. F. Tatnall to the Pittsburg, Pa., agency, with headquarters at 215 Carnegie Bldg. W. J. Hannan has been appointed traveling salesman and will superintend the erection of a large number of furnaces in Buffalo and Toronto, where orders have been placed with the following companies: Four furnaces for the Toronto water-works, two for Birge, Bros., of Buffalo, and two for the Buffalo water-works.

THE BUCKEYE ENGINE CO., of Salem, O., recently made the following sales through its Pittsburg agency: Three engines, aggregating 1,740 HP., to the Carnegie Steel Co., Ltd.; five 150-HP. engines to the New Castle (Pa.) Electric Light Co.; 100 HP. to the Franklin (Pa.) Steel Casting Co.; engines, boilers and complete steel plant to J. Koller & Co., Napoleon, O.; 160 HP. to the H. C. Frick Coke Co., 140-HP. to the Pittsburg Steel Casting Co., and 340 HP. to the American Water-Works & Guarantee Co., of Braddock, Pa.

THE ACETYLENE LIGHT, HEAT & POWER CO., of Philadelphia, according to the "Times," of that city, has let contracts for the building and equipment of a plant for the manufacture of carbide at Niagara Falls. One contract calls for several buildings to be completed within 40 days; another contract has been made with the General Electric Co. for five generators of 1,000 HP. each. It is also stated that the company has closed a contract with the Cataract Power Co., of Niagara, for 5,000 HP., and that the right to use acetylene has been sold to leading gas companies in twelve states.

RUSSELL & CO., of Massillon, O., has recently placed, through its Pittsburg agency, the following contracts: 300-HP. complete steam plant, Martin's Ferry, O.; 200-HP. complete steam plant, Waverly, O.; one 25-HP. engine for Lustre Mining Co., 500-HP. steam plant for the Somerset (Pa.) Electric Light, Heat & Power Co., two 500-HP. tandem compound engines for the West End Passenger Ry. Co., Pittsburg, Pa.; one 80-HP. engine for the Pan-Handle Provision Co., Oakdale, Pa.; one 150-HP. engine and boiler for the Pittsburg Block Coal Co., and two 150-HP. engines for Chittenden Hotel, Columbus, O.

THE TOTTEN & HOGG IRON & STEEL FOUNDRY CO., of Pittsburg, Pa., has contracted to furnish the bulk of the machinery for the new tin-plate plant that is now being erected by George J. Humbert, at Connellsville, Pa., consisting of four 24-in. hot mills, complete with rolls, etc.; four 24-in. cold mills, complete with rolls, etc.; four doubling shears complete, with engines attached; two standard trimming shears complete, arranged for belt power; one standard bar shear and one of the new improved 38-in. roll lathes; the company also shipping a standard 38-in. roll lathe to the Ironton Structural Steel Co., Duluth, Minn.; a heavy shear for cutting 4-in. round iron to the Minneapolis Rolling Mill Co., Minneapolis; an 18-in. bar train to the Detroit Steel & Spring Co., Detroit; an 18-in. bar train and part of a 12-in. train, and about 30 rolls to the Brilliant Tube & Pipe Co., of Brilliant O.

NEW COMPANIES.—Pomeroy Iron & Steel Co., Pomeroy, O.; $100,000; W. A. Taylor and Myron C. Wick.

Patton Clay Mfg. Co., Patton, Pa.; $50,000, with $5,000 paid in; Treas., W. H. Sandford, Patton, Pa.

Darlington Fire Brick Co., Darlington, Pa.; $25,000, with $2,500 paid in; Treas., George M. Merritt, Pittsburg, Pa.

Cazenovia Marble & Granite Works, Cazenovia, N. Y.; $5,000; Wm. H. Woodruff, Arthur B. Hart and Andrew Whipple, of Cazenovia.

Colwell & Collins Bolt Co., Cleveland, O.; $35,000; A. L. Colwell, C. E. Collins, H. R. Collins, H. A. Garfield and others, of Cleveland.

The McWilliams & Arthur Co., New Haven, Conn.; to carry on a general building business; $10,000; Alexander McWilliams, Frederick W. Arthur and Agnes McArthur.

Scott Motor & Machine Co., San Jose, Cal.; $500,000; B. W. Scott and N. R. Carson, of San Jose, and A. B. Acosta, John G. Fitch and C. H. Miller, of Los Gatos.

Bone Hill Consolidated Phosphate Co., Portland, Me.; $1,000,000, with $50 paid in; Pres., Louis E. Lovejoy, of Melrose, Mass.; Treas., Thomas E. Clary, of Norwood, Mass.

Granite State Mica Mining & Improvement Co., Portland, Me.; $150,000, with $300 paid in; Pres., Charles L. Davenport; Treas., Edgar A. Parker, both of Malden, Mass.

Commonwealth Rubber Co., New York, N. Y.; to manufacture rubber goods and railway supplies; $25,000; S. F. Randolph and H. P. Randolph, of Brooklyn, N. Y.

The Dittrick Mfg. Co., Cleveland, O.; to manufacture life guards for street cars and other vehicles; $50,000; R. Dittrick, A. A. Dittrick, W. B. Blake and others, of Cleveland.

Louis Weber Building Co., New York, N. Y.; to do a general building and contract business; $15,000; J. C. G. Hupfel, Charles A Stadler and Henry Waller, of New York.

Chemical Paint Co., San Francisco, Cal.; $100,000; H. E. Miller and C. O. G. Miller, of Oakland; E. S. Heller and F. Thomas, of San Francisco, and W. H. M. Baurhyte, Alameda.

Brady Mfg. Co., Brooklyn, N. Y.; to manufacture articles in metal and wood; $100,000; Edward C. Ward, Elizabeth Brady and James Brady, of Brooklyn, and John Welch, of Hartford, Conn.

Standard Sanitation Co., Tuscon, Cal.; to handle and dispose of garbage, to sell gas for fuel and light, etc.; $1,000,000; Francis J. Wing, George B. Marty, and E. T. Laundon, all of Cleveland, O.

Central Construction Co., Oshkosh, Wis.; to build a line of electric railway in Oshkosh and from Oshkosh to Kaukauna; $300,000; E. E. Stevens, William F. Gruenewald and M. A. Greenlaw, of Oshkosh.

American Charcoal Co., Binghamton, N. Y.; $50,000; E. J. Bayless and M. J. Corbett, of Binghamton; Wm. S. Gray, New York; Henry P. Whitney, Bradford, Pa.; J. C. Fish, of Corbettsville, and others.

Troy Mining, Power & Improvement Co., Spokane, Wash.; $100,000; George D. Potter, of Wallace, Wash.; Robert Russell, W. J. C. Wakefield and F. K. McBroom, of Spokane, and E. L. Preston, of Troy.

Cornell Lime Co., New York, N. Y.; to manufacture marble dust; $50,000; Alfred Romer, of Brooklyn; Edward P. Swift, Albert See and S. W. Cornell, of Pleasantville, and B. F. Wild, of White Plains.

Roger American Mechanical Carriage Mfg. Co., New York, N. Y.; $50,000; Emil Rogers, Paris, France; Alfred A. Cook, Caleb M. Hillman, Abraham Greenhoot, of New York, and A. H. Walton, Ridgewood, N. J.

Municipal Improvement Co., San Antonio, Tex.; to do a general mining and manufacturing business, and to construct and grade streets and sidewalks; $50,000; John J. Stevens, John S. McNamara and J. P. Earl.

Crown Point Mining & Milling Co., Crown Point, Utah; $1,000,000; Patrick Ryan, Joseph H. Paris, John R. Hickman and Henry M. Ryan, of Crown Point; L. P. Boyle, of Chicago, and George Hall, of Park City, Utah.

Williams Asphaltum Block Paving Co., San Francisco, Cal.; $100,000, all paid in; Henry F. Williams, John H. Bullock, and Loring B. Doe, of San Francisco, Cal., and John S. Kimball and Charles E. Kimball, of Oakland, Cal.

Automatic Dumping Coal Car Co., New York, N. Y.; to manufacture devices for opening and closing doors of coal cars; $200,000; Nathan Barney, George D. Barney, of Brooklyn, and Henry W. Hayden, of New York.

Bowers Hydraulic Dredging Co., Camden, N. J.; $375,000, with $1,000 paid in; Frank C. Somers, Camden, N. J.; Joseph W. Wilson, Samuel G. Lewis and Frank Q. Lewis, of Philadelphia, and Alphonzo B. Bowers, of San Francisco, Cal.

F. H. Kratka Land, Water-power & Improvement Co., Thief River Falls, Minn.; F. H. Kratka, Thief City Falls; Geo. W. Mason, Eau Claire, Wis.; Wm. S. Jamieson, St. Paul, Minn.; Jas. A. Kellogg, Minneapolis; Lewis Johnson, banker, Thief City Falls.

Petit Marran Land & Industrial Co., Belfast, Me.; to buy, rent, sell and improve tract of land in Washington county, known as Petit Marran Point; $2,500,000, with $1,080 paid in; Pres., Edgar F. Hanson; Treas., Gustavus C. Kilgore, both of Belfast.

Smith-Vassar Telephone Co., New York, N. Y.; to manufacture telephone and telegraph instruments and electrical devices; $1,000,000; W. L. Beardsley, Frederick J. Wurster, Joseph F. Darling and others, of New York, and Frank S. Pusey, of Council Bluffs, Ia.

The Allaire Water Supply & Land Co., Allaire, N. J.; to operate at Allaire and Lakewood; $150,000; Hal Allaire, of Allaire; Oliver H. Brown, of Spring Lake; Wm. J. Harrison, of Lakewood; George P. Olcott, of East Orange, and James P. Garrison, of Lower Squankum.

The Philadelphia Pneumatic Propulsion Co., Camden, N. J.; to propel street cars, etc., with compressed air; $100,000, all paid in; Jos. McGlathery, Wm. P. Clement, Robt. G. McGill, Michael O'Brien and Edward Burke, Jr., of Philadelphia, and Charles W. Wood, of Camden, N. J.

United States Gas Co., East Orange, N. J.; to operate anywhere in the United States; $30,000, with $1,000 paid in; George L. Dearborn, Rye, N. J; Wm. A. Douglass, East Orange, N. J.; Wm. I. Quintard, New York, N. Y.; Frank J. Post, Boston, Mass., and Chas. L. Gately, Mamaroneck, N. Y.,

The Mexican National Exposition & Land Co., Jersey City, N. J.; to establish electrical works, water-works, ice works, etc.; $1,000,000, with $1,000 paid in; John R. Dos Passos, Juan M. Ceballos and H. B. Hollins, of New York; John P. Stockton, Trenton, N. J., and C. N. Jordan, Brooklyn, N. Y.

Spring Creek Consolidated Mining & Development Co., Redding, Cal.; to do a general mining business, construct flumes and ditches for irrigation and to build wagon and railroads; $75,000, with $50,000 paid in; J. W. Fitzpatrick, T. W. Foster and others, of Redding, and E. D. Shaw and J. A. Nelson, of Sacramento.

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